DOCUMENT RESUME

ED 210 995 HE 014 609

AUTHOR	McLean, Robert S., Ed.; McLean, Ruth W., Ed.
TITLE	Microcomputers in Higher Education.
INSTITUTION	Council of Ontario Universities, Toronto. Office of Teaching and Learning.
PUB DATE	Oct 81
NOTE	25p.; Not available in paper copy due to small print.
AVAILABLE FROM	Office of Teaching and Learning, Council of Ontario Universities, 130 St. George St., Suite 8039, Toronto, Ontario, M5S 2T4, Canada.
JOURNAL CIT	University Education News; v2 n1 Oct 1981
EDRS PRICE	MF01 plus Postage. PC Not Available from EDRS.
DESCRIPTORS	Art; *College Instruction; *Computer Assisted Instruction; Computer Graphics; Computer Literacy; *Computer Managed Instruction; Educational Technology; Foreign Countries; Higher Education; Information Dissemination; Language Laboratories; *Microcomputers; Music Activities; Organizations (Groups); Photocomposition; Technological Advancement; Telecommunications

ABSTRACT

Some of the areas in which Ontario educators currently employ microcomputers in higher education are addressed in several articles, bibliographies, and book reviews. Various uses of computer-managed instruction and computer-assisted instruction (CAI) at Humber College of Applied Arts and Technology are outlined by Frank A. Ford. Microcomputer CAI at Sheridan College of Applied Arts and Technology is described by Ted Bangay, and CAI work in the language laboratory at the University of Waterloo is considered by Rebecca Anders. According to Nick Scintseff of McMaster University, universal computer literacy should have top priority in both schools and postsecondary institutions during the 1980s. He notes uses of computers and telecommunications in other countries. Computer literacy at York University is considered, based on an interview with Peter Danielson. The need for research to discover how computer-literate students differ from nonliterates and how these differences can be used to make them more effective learners are proposed by Ronald G. Ragsdale. The involvement of artists with microelectronics and computers, which crosses the boundaries of time and space, software and hardware, and culture and technology, is considered by Richard H. Hill, who also discusses the role of the Photo-Electric Arts Department of the Ontario College of Art. Peter Boos describes the Keyboard Computer Music system and its applications, and R. E. Drake describes the purpose of the Educational Computing Organization of Ontario, which seeks to exchange and disseminate information on the educational use of computers in Ontario. An annotated bibliography of microcomputer publications by Ron Adams and a second annotated bibliography on microcomputers and higher education and ongoing applications by Janette M. Baker are presented. (SW)

ED210995

COUNCIL OF ONTARIO UNIVERSITIES

OFFICE OF TEACHING AND LEARNING

UNIVERSITY EDUCATION NEWS

VOLUME 2 NO 1 OCTOBER 1981

MICROCOMPUTERS IN HIGHER EDUCATION

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☑ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

Guest Editors: OTL is pleased to welcome Robert S. McLean, Department of Measurement, Evaluation, and Computer Applications, The Ontario Institute for Studies in Education and Ruth W. McLean, Coordinator, Professional Development, Humber College of Applied Arts and Technology as guest editors of this issue. Both have been actively involved in the introduction and use of microcomputers at all levels of education.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

Council of Ontario Univ.

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

Microcomputers and instruction: the topic is so new, so broad, and has so many implications for the future. Although essentially non-existent five years ago, microcomputers now offer such a wide range of possibilities for use in post secondary education that it is hard to know which applications and implications to feature in this issue of University Education News.

We have attempted to provide an indication of some of the areas in which Ontario educators currently employ microcomputers, in the hopes that it will be an indication of the breadth of this field. There are many interesting microcomputer projects going on in Ontario education, but they often happen in isolated pockets of activity. There is a need for communication about those activities, so that others can adopt, criticise, change, invent and build upon the accomplishments of others. This edition of the University Education News is one such attempt at communication.

Why microcomputers are important

Microcomputers are the most personal portion of the "information revolution" — that current event now surrounding us with computer applications in every phase of our daily lives. Most of the information revolution is made possible by high technology developments in a field called microelectronics. Simply put, this is the technology that has accomplished the construction of thousands of transistors on areas of silicon wafers — called "chips" — smaller than your little fingernail.

Now, such miniaturization is not so important, except for the fact that these complex circuits can be manufactured by industrial processes, very cheaply. The microcomputer you might buy for $500 to $3000 contains a $10 processor "chip" much more powerful than the original computers which occupied full rooms and cost millions of dollars.

Thus the important aspect of the microelectronics revolution is the possibility of making information processing by machine cheap enough that a significant proportion of society can afford to have it through individual ownership. It is the popularization of computer power for the masses that is most important.

Higher (or indeed, any level of) education is very much concerned with information: its accumulation, classification, processing, and transmission. When new ways of dealing with information arrive in the surrounding culture, education should take note.

Information technology, in the form of writing and then mechanized transmission of writing through the printing press, altered the very nature of higher education as well as its efficiency. The present information technology innovation appears to be at least as important as the previous ones. The effects promise to be both quantitative and qualitative, yielding changes in efficiency of learning and teaching, but also altering what is taught and learned and the intellectual skills employed in those activities.

Classes of uses of microcomputers

For most purposes, it is useful to distinguish two aspects of any computer application. There are data, which are the substance that the computer processes and the process that the computer carries out using the data. The process is usually called a *"program"*.

It is useful to focus on this duality for a moment. We have had data (commonly called information) as part of our culture for millions of years; we are comfortable with data being "out there" for processing by human brains. Prior to 1980, and for practical purposes prior to 1976, when the first personal computers appeared — we had no significant device for processing information outside of a human skull. We now have the ability to externalize information processes as well as data. We are only just beginning to learn how

HE 014 609

to express such processes effectively, but the fact that we are doing it at all marks a significant shift in our intellectual capabilities. Perhaps it also marks a new era in what it means to be a human being, since much of being human derives from our information processing capabilities.

With the duality of process and data in mind, we can sample some of the uses of computers in education.

Storage, transmission and access to information

Higher education has been involved in this pursuit for a long time. Increasingly, computer data bases will be used for research by both faculty and students: after all, the computer is one of the tools students will be using in intellectual pursuits outside the university or college.

The Canadian development, **TELIDON**, is an example of a data access tool which uses computers; it will be accessible in your own livingroom through an augmented television set. Other databases (e.g., the last few years of the **Globe and Mail**) are currently available through a microcomputer and a telephone coupler (a *"modem"*), but the cost is usually high. While waiting for the general availability of databases, however, you can use a microcomputer to organize your own files of any kind — references, lesson outlines, data or scholarly research. Information can be stored locally on *"floppy disks"* — magnetic media resembling small phonograph records.

Instructors keep records about students, as well. If this information is organized for computer use in tracking the progress of students, it is called **computer managed instruction** (CMI). **Frank Ford** describes several such uses in his article.

Emulation of a well-understood human process by computer

This is the first step in realizing the computer's potential for performing processes autonomously. **Computer assisted instruction** (CAI) is one well known example. Here, the instructional designer attempts to emulate many of the best aspects of human teaching performance. While it is not always easy to do this well, the result of any such attempt is a tangible product, the behaviour of which is open to scrutiny and improvement. Iterations through stages of formative evaluation of the materials during actual student use gives the opportunity for refinement rarely possible in the human's teaching routine. The reality of CAI on microcomputers is far from the vision of the all-understanding, all-knowing tutor sometimes featured in science fiction glimpses into the future. The development effort required is considerable if one wishes to have an effective package: it requires about the same amount of effort as to produce a good textbook. It is something that an individual can do, however, because of the democratic nature of this technology. CAI produced by individuals working alone is more nearly analogous to dittoed materials than polished textbooks; this is not to say that it is necessarily useless, in certain contexts.

Microcomputer CAI is being developed on a more organized basis, as **Ted Bangay** of Sheridan College and **Rebecca Anders** of Waterloo tell us.

Instrumentation and process control constitute another area where computers can be used as extensions of traditional processes. In the laboratory, microcomputers can be used to monitor experiments and to adjust processes. Student involvement in such instrumentation helps them to gain an understanding of a computer use essential to modern industry and becoming important in our environment. Computers now control traffic lights and automatible engines and even life support systems ranging from the air conditioner to the hospital intensive care monitor. Incidental learning through observation or use of such systems can make a major contribution to computer literacy about the world in which we live.

New tools evolve from personal information processing technology

The new tools sometimes grow out of human processes, but as microcomputer capabilities are discovered, invented and understood, new processes come into being through the invention of clever software.

On the surface, **word processing** is the extension of a typewriter to perform many functions that humans previously did with that machine. The result of putting those processes together, for performance by a computer, gives new facility that didn't exist in the human version. An example can be seen in the ease of alteration of documents, inviting active experimentation with the structure and content of textual expression. Beyond such *"tinkering"* with text, word processors also can encourage successive elaboration and refinement of a document from outline to finished piece. Microcomputer word processing software offers most of the functions of the more expensive equipment specifically designed for word processing.

Such computer support is not limited to textual expression, however. Analogous capabilities can be found in **music composition**, for example. Since the computer can also take the role of performer, the creative process — whether it be active experimentation or successive refinement — can be aided by computer, as described by **Peter Boos.**

Inventive planning aids are appearing on the software market, many aimed at business projections, for example. One of the most widely acclaimed, **VisiCalc** (TM), is modeled after a scratchpad. The *"scratchpad"* is divided into rows and columns, forming cells. Each cell can contain text (label), numeric information, or a notation on how to find the cell's numeric value from the values in other cells. The simple scratchpad model makes it easy to express the relationships, and the computer support behind the model carries out the calculations. What is impressive and important, however, is that after the problem has been worked out for an initial set of values, any change of a value in cell immediately causes all other cells to be updated. The result: a *"semi-intelligent"* scratchpad: once you've figured out a problem on it, it will do the same figuring for any other values you wish to supply, and do so almost instantly. One might conclude that the sorcerer's apprentice is being invented, bit by bit (pun?). The possibilities for such modeling and exploration of the behaviour of models just didn't exist before because of the difficult of carrying out the calculations and manipulations.

Presumably, we've only scratched the surface: new processes to augment our intellectual capabilities are being invented by software companies, wanting to sell to the expanding microcomputer market. In fact, the program described above doesn't even exist for large computers!

Communication and manipulating of ideas

The intellectual tools being built with microcomputers have implications for how **knowledge** is **represented** and **communicated.** Many of these developments will be made in the personal computer realm.

When we use text to describe an idea, the transmission is imperfect. The listener has to fill in the cracks caused by different backgrounds, poor communication conditions, imprecise language, and a host of other reasons. Various notation systems have been developed to overcome some of this imprecision by constraining the vocabulary and imposing limited syntax and semantics. Computer languages and computer based notation for **modeling** goes a step further. Since the notation can *"behave"* (because the computer can carry out the instructions implicit in the notation), abstract notions can have very concrete representations and results. The receiver of the communication can view the concrete expression and behaviour of the computer realization of the original idea. The receiver can test proper understanding by inferring from his understanding what should happen if changes are made to the model, make the changes and see whether the predicted behaviour occurs. This facility has only trivially been available before microcomputers.

The review of **Seymour Papert's** book **Mindstorms** suggests other implications and uses for ths *"concretization"* of abstract notions, and the revolutionary impact they could have on education.

Implications for education

We cannot do justice to the implications here, but only suggest a very few. The sampling of computer uses given above suggests that a new tool to support intellectual activities — including teaching and learning — now exists. It exists in the *"real world"*, where *"real people"* now have a powerful and evolving set of information tools to augment their intellectual activities.

Post secondary education needs to take account of this evolution and to adopt and encourage its more adaptive, creative, and mind-expanding components. The development of the technology will continue at a rapid pace, seeming to outmode our current understanding in short order. Yet it is appropriate for each individual to find a personally meaningful aspect of this development and to

learn with it. The accumulation of human experience with the fruits of this technology is the greatest factor in its proper development.

The microcomputer is information technology democratized — it can be the great equalizer of opportunity in the information domain. Because of the technology's youth and its inexpensive availability, there is not much of an *"establishment"* already in place. Young and old have the opportunity to explore together. Many young people, from preschool onward, are now involved with computer experiences of a broad range of types and quality. As these young people who are comfortable with information processing technology as a natural part of their environment make their way through the school system, the higher levels of education will need to adapt to an uneven clientele. **Ron Ragsdale** suggests ways of anticipating the effects of such maturing computer literacy in our students.

Resources for learning more

How can the interested educator start learning about this new field? An article in this issue by **Nick Solntseff** and one from the **York Gazette** describe computer literacy activities at McMaster and York Universities respectively. **Ted Bangay** describes Sheridan's "learning by appointment" arrangements and other activities. These, and other continuing education courses offer the chance to begin your computer literacy work.

Many learning opportunities lurk in the computer stores now appearing in most cities. Part of the task of establishing a customer base includes explaining how computers work and what software is available for particular applications. Try to ask as specific questions as you can, and try to get actual demonstrations whenever appropriate. At most computer stores and in some libraries, you can find many microcomputer periodicals which explain the field to newcomers and experts alike. **Ron Adams** reviews a selection of those applicable to education.

Learning effective use of microcomputers in instruction is more than just normal computer literacy, however. By far the greatest need is to know a range of educational applications, and to know them in a tangible form. Visits to experience other educator's applications would probably be best, but this is not always possible. **Janette Baker's** bibliography cites many articles which describe ongoing applications. Don't restrict yourself to your field, however, since the application in another area of study may be useful in yours, too.

Richard Hill's article suggests microcomputers and art as being a natural part of the contemporary renaissance person. The **Computer Culture Exposition** announcement describes a week-long series of events putting such cross-discipline attitude into perspective.

Perhaps educator-to-educator contact is the best. **Bob Drake** describes an Ontario organization devoted to encouraging that exchange of information: the **Educational computing Organization of Ontario.**

And so . . .

As we said, it's a big field. Some people suggest that computers in education may be a fad, as so many promised technological *"saviours"* of education have been in the past. Computers occupy an ever increasing portion of *"real world"* activity, regardless of education's adoption. The microcomputer is the means for individuals — especially individual educators — to have a significant *"piece of the action"*, and to contribute to understanding of computers in education and in society. There are many, many different opportunities . . . and lots to learn.

COMPUTERS AND POST-SECONDARY EDUCATION

By Nick Solntseff, McMaster University

The widespread use and availability of computers and telecommunications in industry, commerce, health care, science and engineering, and eventually in the home have the potential for bringing about marked changes in society and its institutions. There are several implications for schools, as well as the universities and colleges (CND77).

Firstly, **universal computer literacy is a goal to be sought** because the workaday world is computer intensive. The designer at General Motors, the traffic planners, the bank managers, the travel bureau owners, the grocery store operators, and the politicians must have a working knowledge of computers. In the long run, computer literacy will be achieved at the elementary and high school levels, but, at the present time, universities and colleges have a part to play in meeting society's needs in this area (LUE80).

Secondly, **the uses of computers in everyday life and education are not limited** to numerical areas because the computer is a general purpose tool. Word processing, information retrieval, and telecommunications are already the dominant applications in commerce, industry, and the professions. These non-numeric applications will also predominate in consumer computing.

Thirdly, **the use of computers by researchers** at places such as IBM, Bell Labs, and General Motors is increasing and evidence suggests that if thinkers are given a system that is easy to use, that is reliable, that is accessed from their desk, that automatically manages their data, and that has a response time of less than one second, then they will use it in ways that can only improve their productivity (GAM78). There is also evidence that indicates that text-editors can improve report-writing productivity by several times (GOL80). The productivity of the teacher (however it is defined and measured) will also improve if he or she is able to obtain assistance from an educational computer system.

Lastly, **computing and telecommunications can and will influence education** in ways that other technologies do not. A properly designed educational system restores the possibility of a private person-to-person contact between the teacher and the student and allows the delivery of individualized instruction. Education will be revolutionized if this type of student-teacher interaction penetrates into the home. The goal of private tuition is now within the reach of everyone (EVA79).

The areas of immediate concern should be:

1. The raising of the computer literacy level of the present generation of students,
2. The introduction of continuing education courses to provide up-to-date knowledge to the practicing professional scientist or engineer, as well as others who wish to enter the computer field,
3. In-service training of school teachers to enable them to teach computing, as well as to use computers to support their teaching activities, and, lastly,
4. The education of the general public concerning computers and their impact on society.

As far as the first goal is concerned, the recommendations of the **Elementary and Secondary Schools Subcommittee of the Association of Computing Machinery** (ACM80) can be applied to post-secondary institutions. These recommendations are that

1. all students should be provided with instruction about the role of computers and communications in modern life and their effects on society, so that they can make reasoned judgments about policy decisions,
2. all students should be taught about the power, usefulness, and limitations of computers and communication devices,
3. all students should have access to computer and communications systems for the creation, storage, and modification of information to be shared with others, including the teacher.

The computing equipment provided to the student should have adequate word-processing and filing facilities, as well as means for the student to communicate with his teacher and tutors. Thus, a good electronic-mail system is one of the more important requirements of an educational computer system.

The second goal, continuing education, is currently being addressed by both post-secondary institutions and the professional associations. Seminars and tutorials are being provided in conjunction with conferences and short courses are being offered by industry, the universities, and professional groups. The main obstacle to wider offerings by universities is the growing shortage of teachers, a world-wide phenomenon for which there does not seem to be any immediate solution.

The third goal, in-service teacher training in computing, is largely ignored in North America. By contrast, the French government has committed itself to a wide-ranging programme for the introduction of computers into the classroom (HEB80). The Elementary and Secondary Schools Subcommittee of the ACM has prepared thorough guidelines which define the scope and substance of the teacher training required to integrate computing into the schools (ACM80). This extensive report discusses the competencies needed by all school teachers if they are to assist society at large to become computer literate, the competencies needed by the teacher to utilize computing in presenting subject related material, as well as the specialized skills needed by computer-science teachers. The material to be covered during teacher training is as extensive as any undergraduate computer science programme and this has to be supplemented by additional material dealing with teaching about computers and their uses in society.

In-service teacher training presents a major resource problem to post-secondary institutions. In a period of increasing computer-science enrolments, a static or dwindling faculty population, and ceilings imposed by inadequate government funding, the implementation of Canadian provincial or national programmes for teacher training is very unlikely without the commitment of substantial amounts of money. On the other hand, the cost of not proceeding with the programme for teacher training is also considerable, since other nations, notably, France, West Germany, and Japan have committed themselves to investing in computers and computer education.

The fourth goal, to meet the need for a mass education in information technology, is being acknowledged in Europe and the U.S.A. It has been recognized that there is more chance of public acceptance of new technology if it is made clear that information is a key point in the future growth of the economy. The report to President Carter by the NSF and the U.S. Department of Education (KIR80) points out that there is a correlation between increased technology literacy in Japan and West Germany and rising productivity and share of world trade. Unless Canada follows suit in the immediate future, it will be hopelessly left behind in the world stakes.

In conclusion, it can be stated that universal computer literacy should have top priority in both schools and post-secondary institutions during the 1980s. The changes being brought about by the widespread uses of computers and telecommunications are potentially so great, that the structure of our society may be drastically affected. Therefore, it is imperative that the educational system should produce people capable of a critical appraisal of the situation and instilled with sufficient self-confidence to influence public policy makers in order that beneficial changes are promoted and detrimental changes are inhibited (GOT78).

The practical obstacles to the implementation of a programme for universal computer literacy are considerable. Firstly, the commitment of substantial amounts of money is required on the part of the Provincial and Federal governments. Secondly, a provincial or national plan to foster computer literacy is required, as otherwise duplication of effort and squandering of available resources could result from a "fragmented" approach. Thirdly, the problem of in-service teacher training must be tackled in a resolute manner, because universal computer literacy requires that every school teacher be familiar with what the computer can do for him and his students.

References

(ACM80) Association for Computing Machinery, Elementary and Secondary Schools Subcommittee Preliminary Report (February 1980), pp. 26-39.

(CND77) "Overview of Instructional computing," in **Computers in Undergraduate Teaching**, CONDUIT (Univ. of Iowa), Iowa City, Iowa 52240 (1977), pp. 3-40.

(EVA79) C. Evans, **The Mighty Micro**: Victor Gollancz Ltd., London (1979), 255 pp.

(GAM78) R.C. Gammill, "Position Paper on: Personal Computers in the 1980s," **SIGPC Notes 1**, 2 (Summer 1978): 18-28.

(GOL80) A. Goldberg and D. Robson, "Sharing Problems: Personal Computers as Interpersonal Tools," Keynote address given by first author at the SIGSMALL/SIGPC Symposium, Palo Alto, CA, unpublished (1980).

(GOT78) C.C. Gottlieb, "Computers in the Home. What They Can Do For Us — And to Us," Occasional Paper No. 4, Inst. for Research on Public Policy, Montreal, P.Q. (October 1978), 65 pp.

(HEB80) J. Hebenstreit, "10,000 Microcomputers for French Secondary Schools," **Computer** 13, 7 (July 1980), 17-22.

(KIR81) J. Kirchner, "Institute for U.S. Information Policy Proposed," **Computerworld** 15, 2 (January 12, 1981): 15.

(LUE80) A. Luehrmann, "Computer Illiteracy -- A National Crisis and a Solution for It," **Byte** 5, 7 (July 1980): 98-102.

COMPUTER LITERACY AT YORK UNIVERSITY

During the past academic year **York University** took its first steps in developing faculty and staff understanding of microcomputers and their possible role in higher education.

The following article interviewing **Professor Peter Danielson** of the Philosophy Department appeared in the **York Gazette**, October 3, 1980 and is reprinted below (with slight modifications).

How is a computer like an automobile? Both began with public scoffing, and some fear and resentment that conventional "horse and buggy" methods were being discarded. Both allow the user to travel great distances at rapid speed with great convenience and ease of handling. Both facilitate communication, and soon the computer will be as much a part of the average North American household as the automobile now is.

Because of the growing use of computers, and the need for educated and demanding consumers, the **Faculty of Arts** offered three seminar series on computer literacy.* Faculty, librarians, and senior staff members were invited to participate in these "hands on" meetings, which took place once every three weeks beginning October 15.

Series A, *Get That Chip Off Your Shoulder — The Challenge of Computer Literacy*, was for those interested in the impact of information technology on the university community and on their professional lives. Demonstrations of machines and programs by the faculty that now use or that originally designed them provided hands-on experience and an opportunity to discuss implications. Participants examined the advantages of text editing machines and computerized authorship; the basis behind claims of machine thought and learning; and the intellectual significance of computer graphics, gaming, and music.

Series B offered an *introduction to instructional computing*. This was a practical seminar for instructors interested in introducing computing into their teaching. Emphasis was on sample projects proposed by participants such as adapting a simulation game to a particular historical situation, writing a program to manipulate text, or using specialized graphics for experiments or demonstrations. Instruction in the languages BASIC and Pascal, and applications packages for graphics or music, were available for members willing to undertake fairly independent study. Practical problems of student access, implementation standards, and documentation were

also considered.

Series C, the user's group, presented *a seminar and meeting place for those already involved in educational computing, especially those using personal computers.* Emphasis was on sharing practical results, such as getting the UCSD Pascal Assembler to work, selecting the best 3D package or text editor, and finding ways to link personal machines to shared facilities. It was hoped that this group would work on the practical problems of sharing equipment, easing access, and distributing the much-touted benefits of the computer revolution to the University community.

Philosophy professor **Peter Danielson,** the director of the seminars, explained that these were not technology and society courses, nor were they geared to creating more technocrats. Instead, they were designed to make faculty members from all disciplines more comfortable with computers and their possibilities. They took the critical skills now applied to film and literature, and extended these to evaluating computer software — Are the programs to the point and helpful? Are they presented aptly and with wit?

He spoke of computers as extremely useful machines, as intelligence amplifyers that will soon be used as readily as libraries are now used for information retrieval. He stated that their power as a tool is a function of the interesting ideas inserted, and that the university community is the ideal place for their investigation because of the high value already place on literacy and on creative thinking.

Just as calling long-distance is "the next best thing to being there", simulating situations via the computer can bring past, present, and future problems to life. What is the social value of an air traffic controller? — program the computer to simulate being one and discover the problems, tensions, and closeness to the edge for yourself. How do you keep a nuclear plant from going under? — play "Three Mile Island" computer game and find out. How can you make your students understand what it was like to be a factory owner in the nineteenth century, or a feudal lord in ancient England? Again the computer with its interactive programming can make the exercise seem a real and challenging experience.

*The series described here took place in the Fall 1980. A second series took place in the Spring 1981.

— — —

In addition to their work with faculty, York University is also offering for the first time this fall a credit course for non-computer science students called **Computer Consciousness: What Can the Computer Do For You and To You. Dr. Jerry Durlak,** of the Mass Communications Program, who is teaching the course, indicated that within three hours of registration opening, the course was full and large numbers of students were turned away. What will they miss? Dr. Durlak enthusiastically described the course as follows.

Using an Apple microcomputer connected to 14 television screens, students will have an opportunity to explore what computers are and how they can be "instructed" to do what you want. Durlak stressed that developing programmers was not the course's aim. After a brief introduction students will be exposed to some of the microcomputer's applications in graphics, music, conference networking, and simulations. To wrap up this portion of the course, students will discuss the social implications of computers in cash, crimes, and privacy.

During the latter half of the course, the emphasis will shift away from specific applications towards an overview of artificial intelligence, its relation to increasing automation, and its impact on the future of work, industrial relations, and unions. The course will culminate in an analysis of the information society and its relation to the future of democracy. For further information on these programs for faculty and students contact: **Dr. Peter Danielson,** Philosophy Department (416) 667-2277 or **Dr. Jerry Durlak,** Media Communications Program (416) 667-6272.

ECOO and You

R.E. Drake, President, ECOO

Annual membership: $10. Address: ECOO, 252 Bloor St. W., Toronto, M5S 1V6.

ECOO is the **Educational Computing Organization of Ontario.** ECOO's purpose is the exchange and dissemination of information on the educational uses of computers in the province of Ontario. ECOO organizes conferences, conducts workshops, and publishes a quarterly magazine. In addition ECOO tries to assist policy makers in determining the computing needs of educators.

ECOO's short history began in September 1979 with a 7 member organizing committee. Growth has been rapid, from 12 in November 1979, to 200 in January 1980, 600 in January 1981, and over 1300 at this writing. May 1980 saw ECOO's first conference at Harbourfront in Toronto with about 250 attending. A working conference to suggest policy for computers in Ontario education was held in December 1980. Administrators, educators, Ministry officials, Ontario Teachers' Federation, OECA, TV Ontario, manufacturers' representatives, and publishers contributed recommendations. May 1981 saw ECOO's second annual conference drawing over 800 and turning away over 400. World leaders in educational computing contributed to the conference's overwhelming success.

ECOO reflects many interests. University professors, lecturers and students, college faculty, librarians, administrators at all levels, elementary and secondary teachers, and the Ministry of Education are all represented by ECOO's members, board of directors, and executive. ECOO is cross-subject and cross-level oriented. The use of or interest in computers in education is the only criterion for ECOO's interests.

ECOO is most visible through its Newsletter. Informing the educational community of happenings in Ontario is its primary function. News of interest from elsewhere is included as are ideas, techniques, literature reviews, and opinions. The newsletter reflects ECOO in that it is not aimed at the computer specialist but at the educator using computers in the classroom.

What can ECOO do for you? As a body devoted to advancing computing in Ontario education ECOO is a resource for instructors using computers. We can help you avoid 'reinventing the wheel' when you start looking at computer applications for your subject. We can help you find others in your discipline also using computers. We can explain computers to you in plain language. Computers do more than you imagine they do. Computers are not a technical wonder beyond your capabilities. Your students are using computers. Computers can help them with their job of learning. Computers can help you with your job of teaching. ECOO can help you learn about computers.

What can you do for ECOO? Without your participation, we cannot fairly represent you, your ideas, your opinions. We cannot try to answer your desires and needs. Work being done elsewhere may answer your questions. On the other hand, if we cannot tell others of your work, they may duplicate your efforts and errors without finding your success. Direct or indirect applications of your work may not develop. We need you as much as you need us.

Join ECOO. Learn about and contribute to educational computing in Ontario.

The Computer Goes to College

By Frank A. Ford, Humber College of Applied Arts and Technology

Our College administration decided with foresight to go willingly into the computer age. Even the classic battle between main-frame and the stand-alone mini's has been won. Both systems are now seen to have their place. Here is a report on how the minicomputer has become central, vital and loved in one small part of the College.

BACKGROUND

Our teaching area operates four continuous-intake self-paced skill-oriented programmes. Total enrollment runs from peaks of about 100 full-time and 150 part-time students to lows of 40 plus 100 during the summer 'quiet' time. We use three full-time and seven part-time teachers.

CONTINUOUS INTAKE means that a student can begin the programme at any hour of any day of the year. The programme runs during conventional day-school hours and also runs afternoons, evenings and Saturday mornings. Students may elect either part-time or full-time attendance. Within some limitations, students may attend for their total number of contracted weekly hours at any time they wish.

SELF PACED means that each student works on his own at his own speed. He works through a sequence of 'packages'. Each package has one small, carefully defined, measurable performance objective. He is tested before moving on to the next package in the sequence. Package sequences can be tailor-made for each student depending on the overall objective for his attendance.

SKILL ORIENTED means that each student is developing a sequence of specific, defined objective skills. If we are training him to repair faulty upside-down signal grabbers, we do NOT care, as such, how much he knows about the units. We DO care about whether or not he can repair a faulty unit.

COMPUTER USE

Commodore PET minicomputers (with ancillary peripherals) are used extensively.

When a student begins the programme he learns immediately how to use the PET terminals. He begins each day by signing in on a PET. His progress tests are marked by PET. The PET tells him if he is doing work out of order. If he is taking unusually long on a package, the PET alerts us. When he is finally ready to graduate, it is the PET that prints out his transcript.

Increasing volumes of routine matters are being handled by PET rather than by teachers. The quality of teacher-student interaction time is becoming higher as we make increased use of our PETs.

Here are the specific tasks handled by PET:

1) **TEACHING** All students complete two instructional assignments using the PET. One assignment teaches and drills a specific technical skill; one teaches the use of the PET itself.
   We also have two remedial drill programmes which are used by students who need special help.
   We make limited use of PETS in teaching, per se. The cost of providing 20 or more terminal-hours per student per week is out of sight. We provide about 2 terminal-hours per student-week.
2) **TEST MARKING** Each student writes from 2 to 5 tests each week. Fifty to one hundred tests are marked daily by PET.
3) **STUDENT MARKS** All student records are held in PET disk files. Files are updated automatically as tests are successfully completed.
4) **STUDENT ATTENDANCE** Students begin and end each day at the PET. Attendance reports are printed routinely for our Registrar's office.
5) **ABORT FLAGS** Students may incur bureaucratic ire by not returning library books on time, by overdue tuition fees, by retaining unreasonable quantities of resource material, by not meeting minimum performance standards or schedules, by attendance irregularities, or by any other failure to conform (!). All such cases set a flag in the PET system. Students in default are automatically denied access to the system until they clear their default.
6) **DIRECT MODE** Students use the PETs in direct mode as powerful desk-top calculators.
7) **REGISTRATION** Part-time students register directly with the class-room teacher for blocks of ten sessions. Each registration must be supported by a new application form. These forms are printed by PET, and together with the applicant's cheque or money order are sent to our Registrar's office to complete the registration. Being continuous intake programmes, each session will have up to ten new or renewal registrations. A minimum of student and teacher overhead is required. Non-teaching administration time is reduced to a minimum.
   Part-time students who attend class but whose fee payments are not current are automatically alerted by the PET system.
8) **FEE STATUS** Full-time students pay fees in blocks covering several months. Students in arrears are held up by the system until fees are paid.
9) **ILP PACKAGE PREPARATION** The Individual Learning Packages comprising the student material for the programme are printed by PET. A dedicated word processing system allows a teacher to prepare a completely formatted package. He sits at the keyboard and answers questions put to him by PET. The PET prints out completed ILP packages.
10) **PROGRAMME SCHEDULE** Each student has an overall schedule of packages he must complete. There are four main schedules. Individual tailor-made programmes are offered to students with specific needs. These custom programmes may vary from 1 to 50 weeks in duration. Schedules are composed, filed and printed by PET.
11) **TIMETABLES** All teacher, student and class timetables for this programme area are prepared, checked, printed and filed by PET. Faculty loading, class sizes and room allocations are also dealt with by PET.
12) **OFFICE SUPPORT** All inter-office correspondence and all external correspondence is prepared, edited, typed and filed by PET. Multiple address letters are produced automatically. Routine mailings are completely automated. Envelopes are addressed using labels printed by PET.
13) **LAB EQUIPMENT INVENTORY** Inventory lists are maintained by PET.
14) **PURCHASE REQUESTS** Most supplies are ordered, inventoried and expedited using PET.
15) **BLANK** This blank item is to serve as a reminder that by the time this report is published there will be another item (as yet unknown) to insert here. Our growing student/teacher ratio and our shrinking student/space ratio is viable only with increased computer aids.

A few additional comments cover the ever-pressing security question. A student can gain access to his own file, but he can make no changes to it. If he himself maintains security over his own student registration number; no other student can see his file. Only a teacher can intervene to change a file. A student's file is automatically changed whenever he passes a test successfully. All disk files are duplicated to protect against catastrophic loss of data.

All software has been written by teaching staff. The one exception is our use of WordPro 3 (Pro-Micro Software Ltd.) for correspondence and report writing.

CONCLUSION

In 1978, one teacher in our area had just started getting used to mini's by writing a dedicated word processing programme to prepare instructional packages. His foresight and drive has sparked the chain of events that brings our College to the forefront of utilization of small stand-free systems. His work has spawned such diverse uses as:

— drill and training in a geography lab, Travel and Tourism area
— remedial spelling, Typing Lab
— spatial orientation and shape perception testing and training, Early Childhood Education area.

We go willingly into the computer age; there is no alternative.

MICROELECTRONICS, COMPUTERS AND THE ARTIST

By Richard H. Hill, Ontario College of Art

**This paper was prepared for the Twelfth Ontario Universities Computing Conference, June 1981.*

If Leonardo da Vinci were alive today I am sure he would be involved with microelectronics and computers. He not only painted the Mona Lisa but also designed such things as helicopters and submarines. Besides being a painter and a sculptor, Leonardo was a self-taught scientist, technician, engineer and inventor. He was at the leading edge of technology and innovation as it stood five hundred years ago. However his interest in machines was primarily in their manifestation of human intelligence and genius. As an artist he believed his work was important because it came from the mind.

Leonardo da Vinci ignored boundaries when integrating theory and practice in the pursuit of his interests. He investigated, documented and speculated on the nature of the world around him using the most advanced theories and technology of his time. From his study of the human body, of the fight of birds and of the force of water, he created new images and inventions which profoundly influenced the formation of modern culture and technology.

You might say that Leonardo was unique. Of course he would be involved with microelectronics and computers today — not because he was an artist but because he was Leonardo da Vinci. Yes, he was a genius, an exception, yet he was also representative of the early Renaissance concept of the artist — a concept which seems to have been lost sight of today.

The idea of the visual arts is a Renaissance invention based on the marriage of the liberal arts, which then included mathematics, poetry, music and astronomy, to the technologies which produced buildings, paintings and sculpture. Art involved an innovative cross-fertilization of the intellectual and technological developments of the time. As a result artists were amongst the leading innovators of the fifteenth century.

The early Renaissance artist bridged the gap between the abstract world of the intelligent and the tangible world of the craftsman. By nature he was a rounded person, integrating a variety of interests and activities. Alberti was a lawyer, mathematician, author, scientist, inventor, painter, sculptor and architect. Michelangelo was a sculptor, painter, architect and poet, Piero della Francesca was a painter and mathematician and Raphael was a painter and architect.

Brunelleschi established engineering when he solved the problem of roofing the dome of the Florence Cathedral through calculation. He is also credited with the invention of perspective, a mathematical method of transferring the three dimensional to the two dimensional and vice versa. Alberti formulated architecture by applying the principles of music and proportion to the design of buildings. Artists had to deal directly with innovative problems of metallurgy, paint and construction. They had to modify and experiment with their media in order to accomplish what they had in mind.

Artists crossed into the technology of print, where they developed and invented new methods of reproduction. By 1500 they had established precise methods for the representation and description of physical and intellectual reality, which they applied to anatomy, botany, zoology, architecture, engineering and industrial design. Artists not only put thought into picture, but also wrote treatises on their work and on related interests such as mathematics, fortifications, perspective and proportions of the human body, all of which were dealt with and published by Durer shortly after the death of Leonardo.

The early Renaissance concept of the artist did not last for long with the advance of mechanization and the formulation of different developments into different disciplines. Art became fine art and the artist became increasingly separated from the mainstream of scientific and technological development. Architecture established an identity of its own and applied art became associated with various forms of engineering and design. As Europe became increasingly materialistic, visual art was considered more as an object and a commodity. It was identified as painting and sculpture rather than the manifestation of idea.

With the invention of photography artists lost their hold on the technology of visual representation and art became increasingly something unto itself. By the twentieth century art was generally divorced from a machine-oriented society and justified itself largely on the grounds of aesthetics. Mass media further diminished the role of the artist who is now generally regarded as an odd-ball operating at the fringe of society doing crazy and esoteric things.

The concept of the visual artist is a hang-over from the Renaissance when personal innovation was important. The artist became a misfit as the power of the individual was completely overshadowed by the massive scale of technology. Twenty years ago no one could personally own a computer which by then had become the controlling technology of the mass industrial world. It served to reinforce and extend a mechanically-based system involving standardization, fragmentation and specialization. Modernism implied a blind belief in progressive materialism. Reality was tangible and bigger was better. America symbolized the success of mass modernism which reached its height by the end of the 1950's.

The advent of microelectronics in the 1970's involved radical change. As a result computers in one form or another are becoming available to almost everyone and personal initiative is again becoming a major factor in technological innovation. Microelectronics integrates areas which were formerly separate and creates a need for unprecedented combinations of knowledge, skill and experience. In shifting from large to small and from hardware to software, it gives new importance to personal resources such as intelligence, imagination and initiative.

Microelectronics is penetrating, transforming, and rearranging modern technology. Yet North America is in danger of becoming industrially obsolete as it fails to match Japan and Europe in taking advantage of developments arising from microelectronics. It seems to be set in its own particular ways of mass industrialism and would appear to lack the capacity to adapt through change of approach. The situation is further complicated by shortages of energy and materials in addition to problems of inflation and pollution. We are already involved in the very "unmodern" activities of recycling, renovation and conservation as the industrial dream of modernism falls apart.

I suggest that the early Renaissance concept of the artist is more appropriate today than the "modern" concept of the artist. In many respects our present situation is not unlike that of the early Renaissance. The spread of literacy had broken the medieval monopoly of the church over the information technology of written knowledge, which was then expanded and applied to a better understanding of nature and the advancement of technology. Countries taking advantage of these developments become economically powerful while those failing to do so become technologically backward.

Interestingly enough the Renaissance found the cultural models of ancient Greece and Rome more appropriate than those of their more immediate medieval past. We may well find the cultural models of the early Renaissance more appropriate than those of our own immediately preceding past. The Renaissance promoted an intellectual, pragmatic and imaginative approach to the world which stimulated personal initiative and innovation. Mass industrialism on the other hand tends to favour standardization, conformity and centralization.

Most people are accustomed to think of artists in terms of painting and sculpture. Today this assumption is not necessarily true. In fact the traditional association of the artist with the visual technol-

ogies of the Renaissance has been disintegrating since the mid-1960's. Photography, film and video are now considered media for the artist in addition to kinetic sculpture and holography. Even the former identity of art with an avant garde has disintegrated as artists diversified their activities, flouting convention and seeking alternatives.

Artists turned away from the gallery as container of art and sought alternatives such as wrapped landscapes and earthworks. We have seen concept art, process art and performance art. While these developments by no means affected all artists, they did indicate a definite break with the material identity of art as painting and sculpture. They also placed an emphasis on art as software and brought the artist into direct contact with the photo/electric technologies.

Artists first encountered the computer in its pre-microelectronic form. During the 1960's the potential of mainframe computers for graphics, animation and music was demonstrated by innovative computer scientists. But artists had difficulty in relating to the time-consuming complexities of an alien technology which required their ideas to be painfully translated by computer programmers who stood between them and the results of their work.

John Whitney, experimenting with computer animation in California, was one of the first artists to realize the creative potential of computers, which he identified with ideas to be found in the notebooks of Leonardo da Vinci. He saw the computer as a medium operating in the dimension of time and approached it as a means of integrating the visual and musical arts in new multi-dimensional forms.

Other artists not satisfied with the technology as they found it began to assimilate and modify it for their own purposes. They became innovators and inventors in the tradition of Leonardo da Vinci. **Lee Harrison,** an artist in Denver, developed new systems of computer animation, integrating analogue and digital approaches. In Toronto, **Bill Buxton** developed synthesized sound systems suitable for a musician and used the computer to explore the potential of structuring music in three dimensional space.

The involvement of artists with mainframe computers has been a rather exclusive affair, limited to a very few people who became deeply involved with projects which require substantial funding and facilities.

However with the spread of microelectronics, artists could assimilate computer technology in their own homes and studios, financed from their own personal resources. People, like **Norman White** of Toronto, were able to boot-strap their way through the hardware and software to become innovators and inventors of sophisticated systems manifesting new images, such as his kinetic sculpture involving robotics and artificial intelligence.

Artists can now teach themselves computer programming and build their own computers. They can design small systems dedicated to special purposes. They can experiment with cybernetics, bio-feedback and robotics. They can interface with sound, print, film and video. They can access mainframe systems and network with each other, exchanging electronic mail and computer programs. They need no longer accept media and equipment as manufactured. They can invent, innovate and create, once again integrating culture and technology as in the early Renaissance.

Contemporary artists working with microelectronics and computers are primarily interested in what lies beneath the surface. Like Leonardo da Vinci they are concerned with the implications of their images. They are sensitive to content, context, interface and the interplay of shaping forces. Their work crosses the boundaries of time and space, of software and hardware, of culture and technology. It is programmable, kinetic and metamorphic.

The Photo/Electric Arts Department, which I had the opportunity of founding at the **Ontario College of Art,** addresses itself to the renewed potential of the creative artist. The program encourages self-reliance, creative initiative and diversity of approach. It is deliberately unconventional, but calls for perseverence, concentration and an appropriate integration of learning from related creative, intellectual and technical courses.

Students with no previous technical, mathematical or scientific training are introduced to electrical engineering and computer science by artists whose technical knowledge is largely self-taught. The approach is to understand, shape and apply the technology according to personal interests, working from the inside outwards. Students work with a variety of systems providing them with a flexible basis from which they can adapt to future developments.

The Department is equipped with different off-the-shelf microcomputers such as the Apple and Exidy Sorcerer in addition to a CP/M system and dumb terminals which can access mainframe computers at the University of Toronto. Computers are backed by a choice of peripherals, such as graphics tablets, XY plotters and some custom-built interface devices. Rather than concentrating on a particular computer language, students are given an understanding of assembly language and introduced to contemporary high level languages which are chosen as good points of departure for future learning according to personal needs and interests.

Students are required to explore and familiarize themselves with other photo/electric media, such as film, video, animation, audio and holography. They are expected to develop their own directions and to focus their energies accordingly. They are to learn whatever they wish to accomplish. They are required to carry out all aspects of their work from perception to execution, and may choose from a wide variety of courses ranging from wood, plastics and metal to art history, music and creative writing. In this way they are able to integrate a particular selection of knowledge and experience from different disciplines as they proceed.

Experience at the Ontario College of Art has proved that students coming from a background of drawing and painting can assimilate computer programming and microelectronic technology at a remarkable rate, provided they are motivated to use it creatively for their own purposes. The freshness of their approach and the originality of their ideas can achieve some remarkable results.

Within a year one student with no previous technical experience designed and built a working system whereby a paraplegic was able to communicate effectively through Bliss symbols using an electronic system activated by slight movements of the neck. Another student within the first year of being introduced to computer programming was able to design, build and demonstrate a system whereby a microcomputer drew sound maps of a room from the input of four microphones. Yet another student developed a system for creative video images from the manipulation of synthesized sound and yet another student designed and programmed a musical system which can begin by playing Bach and end by playing popular music, moving through transitions similar to computer animation in-betweening.

The 1980 Computer Culture Exposition which I organized in Toronto, provided an opportunity for students and faculty to interface with the outside world. One of the results was the design and demonstration of the world's first interface between the Telidon videotex system and a micro-computer. Initiated by myself, the project was carried out by **Les Titze** assisted by a graduating Photo/Electric Arts student. Les became interested in microelectronics as a musician in the early 1970's and is now teaching art students to build their own computers, besides heading up the design of further Telidon/micro-computer interfaces. **Saul Goldman,** another member of the faculty and a graduate of the College, exhibited his invention of a micro-computer based lighting display system. It was seen by a Canadian manufacturer, and within months Saul was in business with contracts for more elaborate versions of the system.

If Canada is to catch up to other industrial nations and take the lead in technological innovation it needs more than the traditional approaches of specialized training and institutionalized research. While these are necessary, they need to be complemented by lateral approaches which by-pass unnecessary delays, cross boundaries and release creative energies. We require the inspiration of artists who are not only creative but also have the perseverence and initiative to assimilate the technologies of microelectronics and computers.

The innovative artist working with microelectronics is in an enviable position. As a hang-over from the early Renaissance, the visual artist has never been industrialized or regulated. Unlike doctors, lawyers, engineers, scientists and accountants, artists have a licence to break all the rules and require no formal training. They are recognized as creative individuals operating outside the norms of a specialized and fragmented society. They can move freely between culture and technology touching on a diversity of areas such as biology, mechanics, psychology, religion and ecology.

Microelectronics has seemingly broken the corporate monopoly of high technology and opened it to personal initiative. The traditional reliance of artists on their own personal resources is now an advantage. Human resources are outweighing material resources as software overshadows hardware. The penetration of technology by microelectronics calls for changes of approach as competition,

fragmentation and standardization give way to collaboration, integration and compatability. We still live in a consumer-oriented industrial society and our problems are cultural rather than technical.

Innovation is becoming a necessity and the artist may well return to the main stream of cultural and technological development. There is a need for the pragmatic and imaginative tradition of the early Renaissance. We require the alternate vision of the artist and we also require the humanizing influence of art.

Annotated Bibliography of Microcomputer Publications

Ron Adams, College of New Caledonia, Mackenzie, B.C.

Reprinted with permission from **ECOO Newsletter** 2, no. 2 (June 1981): 24-28.

APPLE MAGAZINE (Free) 10260 Bandley Drive, Cupertino, California, USA 95014.

The Apple Corporation's quarterly catalog disguised as a magazine. It contains several short articles lauding the Apple's versatility as a personal and small business computer plus an up-to-date listing of all hardware and software marketed by the company. It's available at Apple dealers and is sometimes distributed free to potential customers.

APPLEGRAM ($15 membership) Apples B.C. Computer Society. No. 101-2044 West Third Avenue, Vancouver, B.C. V6J 1L5.

The quarterly newsletter of the Apples B.C. Computer Society, a group that includes several of the province's top microcomputer programmers. The newsletter contains software reviews, program listings, short articles on technical topics, buy and sell advertisements, club notices, and a list of programs that members have contributed to a software library that can be purchased for $10 a disk.

BYTE ($21) Box 590, Martinsville, NJ, USA 08836.

Byte is McGraw Hill's monthly attempt to imitate the worst features of Scientific American and the Sears Catalog. The articles are highly technical and frequently devoted to arcane subjects that will bewilder the small systems user that the magazine is supposed to serve. Interesting material is buried in a blizzard of advertising. But it is the leading microcomputer journal and will keep you abreast of the latest developments in the field, not to mention all the new hardware. I buy it for two columns: Bytelines, which is Sol Libes' fascinating analysis of news and rumors in the microcomputing industry, and the Education Forum, which reports CAI projects at various US universities and colleges.

CANADIAN DATASYSTEMS ($15) Box 444, Station A, Toronto, Ontario M5W 1C2.

A relatively inexpensive way to keep track of technical developments in the Canadian data processing field.

CATC DIGEST (Free) Educational Testing Service, Princeton, NJ, USA 08540.

A succinct but academic four-page quarterly newsletter on computer — assisted test construction on large computer systems.

CLASSROOM COMPUTER NEWS ($9 US) Box 266, Cambridge, Mass., USA 02138.

The complimentary issue that I received contained the following articles: Computer Literacy — What Should Schools Be Doing About It; A School Administrator Looks at Visicalc; Special Tools for Special Needs; Programming I — The Starting Gate; Word Processors for Teachers; Microcomputers in the School Library's Future; and How Does the Computer Remember All That Stuff? Need I say more?

COMPUTE! ($18 US) Box 5406, Greensboro, NC, USA 27403.

One of the few magazines that carries separate sections devoted to specific computers (6502 — based machines in this case): the Apple, Atari, OSI, PET, and single-board 6502 microcomputers (AIM, KYM, SYM). It contains regular columns on the social impact of microcomputers, applications for the handicapped, and BASIC programming tips, together with a selection of reviews and printed programs for the Apple user. The bulk of Compute!, however, is devoted to other microcomputers.

COMPUTER AGE (34 pounds 20) 4 Valentine Place, London, SE1, Great Britain.

This British monthly, is, in my opinion, the leading microcomputer journal in the English language. It is comprehensive, well laid out, and written in a brisk, erudite, jargon-free style that ordinary mortals can understand. Topics discussed in recent issues include the office of the future, computer literacy, computer assisted instruction, ergonomics, voice synthesis, the use of microcomputers in medicine and special education, bubble memory, and artificial intelligence, to name but a few. The magazine has also been featuring excellent tutorials in programming languages like PILOT, FORTH, and APL. There's only one problem: the subscription price is seven pounds 20 which is $20 and very reasonable, but the British Post Office charges a king's ransom to airmail it to Canada — 27 pounds — which brings the cost to nearly $100 per year. No magazine is worth that much.

COMPUTERTOWN USA! (Donations) Box E, Menlo Park, California, USA 94025.

The monthly newsletter of a group of enthusiasts dedicated to promoting computer literacy in Menlo Park, California. Their projects include microcomputer fairs, programming contests, and

public demonstrations, as well as the installation of microcomputers in public libraries. It's a good source of ideas on grass-roots microcomputer uses.

COMPUTERWORLD ($65) 375 Cochituate Road, Box 880, Framingham, Mass., USA 01701.

Computerworld describes itself as "The Newsweekly for the computer community" which is to say the programmers, analysts, specialists, data processing executives, and computer centre directors who cope with the big, expensive, and soon-to-be-obsolete mini- and megacomputer systems. The articles, reports, and reviews are fascinating if obscure, but the job classified ads are truly spectacular.

COMPUTING TEACHER, THE ($15 US) Computing Centre, Eastern Oregon State College, La Grande, Oregon, USA 97850.

Edited by one of the leading CAI educators, David Moursund, this journal focuses on teacher education, computer assisted instruction, and the impact of computers on curriculum. Apart from the usual articles and software reviews, The Computing Teacher features reports on CAI projects, articles on instructional design, and an assortment of calculator and microcomputer programming assignments that can be adapted for classroom use. No microcomputer-using teacher should be without it.

CREATIVE COMPUTING ($24 US) Box 789-M, Morristown, NJ, USA 07960.

If you plan to purchase only one microcomputer magazine, this is it. It has all the articles, reviews, program listings, and columns of the other general microcomputer monthlies, plus a sense of humor; it's sprinkled with cartoons, delightful pen-and-ink drawings, satirical pieces, short stories, puzzles, and even the occasional poem. Moreover, it's not limited to computer topics. Recent issues contain an excellent series on effective writing techniques that any writer can use. Don't miss an issue.

CUE NEWSLETTER ($4 US) Independence High School, 1776 Educational Park Drive, San Jose, California, USA 95133.

The bimonthly newsletter of California's Computer Using Educators, an enthusiastic group of several hundred elementary and high school teachers who have just started an educational software exchange. The newsletter outlines their many activities and prints short but revealing software reviews from a teacher's point of view. It provides a model for CUE groups — and is well worth the modest subscription price.

DATAMATION ($45) 1301 South Grove Avenue, Barrington, Illinois, USA 60010.

Up-to-date coverage of hardware developments in the $100,000 range that will make microcomputer enthusiasts drool. Check out a library copy from time to time.

ECOO NEWSLETTER ($10 membership) c/o Sue Moon, OISE — MECA, 252 Bloor Street West, Toronto, Ont. M5S 1V6.

The lively quarterly of the Educational Computing Organization of Ontario, a group of educators dedicated to promoting computer literacy and computer assisted instruction in Ontario schools. They've given Ontario a year's lead over other provinces like B.C. that are flirting with microcomputers in the schools. Unlike B.C., however, the Ontario Ministry of Education has not had the foresight to select a province-wide system.

ILLINOIS SERIES ON THE EDUCATIONAL APPLICATION OF COMPUTERS ($.50 US per paper) Department of Secondary Education, College of Education, University of Illinois, Urbana, Illinois, USA 61801.

A series of academic papers "prepared as resources for the preservice and inservice training of teachers (under) the general theme of teaching with or about computers." I'm not sufficiently well informed in the teacher training field to evaluate this comprehensive series. Some of the material may be dated, but it will doubtlessly be very useful to department of education faculty interested in adding computer assisted instructional technology to their curriculums.

INFOSYSTEMS ($40 US) Hitchcock Publishing Company, Box 3307, Wheaton, Illinois, USA 60187.

An expensive monthly aimed at information systems executives. Apart from the glimpse it gives into the career potential of computer professionals it isn't much use to beginners or educators.

INFOWORLD Circulation Department, 375 Cochituate Road, Framingham, Maryland, USA 01701.

A twice-monthly newspaper aimed at the personal and business microcomputer user that will keep you informed of the latest developments and users in the industry. The coverage is comprehensive and most articles are jargon free. Particularly valuable are its editorials, its many candid software reviews, and its job classifieds, which will quickly convince you that you're in the wrong line of work. Recommended.

INTERFACE AGE ($28 US) Box 1234, Cerritos, California, USA 90701.

An expensive monthly that features one microcomputer system each month together with articles, software reviews, and regular columns on do-it-yourself projects, games, mathematics, and free literature. Program listings are rarely compatible with the Apple. Take out a subscription only if you've got Computer Age, Creative Computing, and a dishwasher.

IRQ NEWSLETTER ($10 membership) c/o Harold Brochman, 3264 St. Georges Avenue, North Vancouver, B.C. V7N 1V3.

The monthly newsletter of the BCTF's new Computer-Using Educators' Association of B.C. (CUEABC). It will keep you up to date on B.C. Teachers' use of microcomputers and merits your support.

ITMA NEWSLETTER (Free, but send 10 pounds for back issues and postage) College of St. Mark and St. John, Derriford Road, Plymouth, PL6 8BH, Great Britain.

The quarterly newsletter of the British Investigations on Teaching with Microcomputers as an Aid project, a rapidly growing group of British teachers dedicated to developing, evaluating, and promoting CAI materials. It features valuable material on CAI techniques and applications articles written by teachers. It contains programming tips and 380Z BASIC program listings that an adept machine language programmer will be able to convert to Applesoft. (Please send them to me if you manage it.) The newsletter furnishes ample proof of Britain's lead in educational applications of microcomputers.

JOURNAL OF COMPUTER-BASED INSTRUCTION ($12 US, free to ADCIS members) Computer Centre, Western Washington University, Bellingham, Washington, USA 98225.

The JCBI is the academic quarterly of the University of Western Washington's Association for the Development of Computer-Based Instructional Systems. The people responsible for putting it out assert that it "publishes original investigations and theoretical papers dealing with direct applications of computing to the problems of learning and instruction, design of curriculum, authoring languages and systems, and comparative curriculum structures for computer-based instruction." Contributors are urged to submit "empirical studies that use experimental procedures which will maximize the potential generalizability of outcomes." Enough said.

MICRO ($18 US) Box 6502, Chelmsford, MA, USA 01924.

A monthly for experienced Apple, PET, OSI, and KYM/SYM/AIM

programmers. Each issue contains one or more useful utility programs for the Apple, but most of the coverage is devoted to the other microcomputers. However, it does have two features that make it worth the subscription price: a monthly annotated bibliography of articles in the many obscure microcomputer journals not reviewed here, and a directory of new software.

MICROCOMPUTING ($27 US) Box 997, Farmingdale, NY, USA 11737.

A comprehensive magazine on microcomputing noted for excellent articles on technical topics as well as for regular features on the industry, educational projects, new products, and book reviews. Editor Wayne Green's trenchant monthly analysis of the microcomputer industry is worth the price of the magazine. Recommended.

MICRO-SCOPE ($10) JEM Research, Discovery Park, The University of Victoria, Box 1700, Victoria, B.C. V8W 2Y2.

The newsletter of the Joint Educational Management Research project, the consultants responsible for the B.C. Ministry of Education's microcomputer pilot project, will keep you abreast of the rapidly growing use of computer assisted instructional materials in B.C.'s elementary and high schools.

NIBBLE ($22.50 US) Box 325, Lincoln, MA, USA 01773.

NIBBLE is a bi-monthly magazine dedicated to Apple users. It is geared to programmers. Each issue features at least two major program listings for home, small business or entertainment use that can be typed into Apple. It also contains a selection of programming tips, hardware construction projects, and product reviews. The major listings may also be obtained on diskettes for $15 or less. People who enjoy programming swear by it and no Apple owner should be without a subscription. Highly recommended.

ON COMPUTING ($10 US) 70 Main Street, Peterborough, NH, USA 03458.

McGraw Hill's quarterly is aimed at the new microcomputer owner. It contains easy-to-read reviews and articles on microcomputers, peripheral devices software and new products, all of which are lavishly illustrated with color photographs and diagrams. It's a useful reference and well worth the price of a subscription

PERSONAL COMPUTERS ($1.75 issue) 1 Fawcett Place, Greenwich, Conn., USA 06830.

Mechanix Illustrated's quarterly magazine on microcomputers. It is designed for newsstand sale — no subscription information was provided in the first two issues — and the articles and product reviews are brief, easy to read, and rather superficial. It won't impress anyone with a modicum of microcomputer experience, but it's a useful introduction for the beginner.

PERSONAL COMPUTING ($22 US) Circulation Department, 1050 Commonwealth Avenue, Boston, Mass., USA 02215.

A monthly containing articles on a variety of topics and regular columns on computer chess, computer bridge, and the future of computing. It is biased toward the TRS-80 and is not high on our recommended list for Apple owners.

PIPELINE ($25 US — membership) CONDUIT, Box 388, Iowa City, Iowa, USA 52244.

A semi-annual report of the University of Iowa's CONDUIT organization, a US government-supported project designed to develop, evaluate, and market computer-assisted instructional materials for higher education. Members of CONDUIT receive Pipeline, a CAI authoring guide, and brochures on new post-secondary CAI materials, some of which are available for the Apple. Pipeline contains several short articles on CAI research as well as a catalog of $50 disk-based programs in biology, chemistry, economics, education, geography, psychology, sociology, humanities, management, mathematics, physics, political science, and statistics. Recommended.

PURSER'S MAGAZINE ($12 US) Box 466, El Dorado, California, USA 95623.

A computer-printed, privately published, no-hold-barred quarterly collection of business, educational, and games software reviews. The magazine accepts no advertising, so if the program is a dog — and a great many are — Purser reports it bluntly. This extraordinary one-man publication may be in trouble: subscribers recently (April 1981) received a postcard urging them to have a little more patience for the long-overdue first issue of 1981. Recommended for the owners of all microcomputers except PET, which Purser shuns for reasons that are not yet clear to me.

RECREATIONAL COMPUTING ($20 US) P.O. Box E, Menlo Park, California, USA 94025.

A brief but excellent by-monthly magazine published by the People's Computer Company, an organization created in 1972 by enthusiasts dedicated to taking computing to the people. It contains concise articles on the use of microcomputers in education, medicine, music, and the home, as well as regular columns on programming techniques, programming problems, and games. It is not overwhelmed with glossy advertising, and each issue contains program listings that can be typed into the microcomputer. Recommended.

SCIENTIFIC AMERICAN ($21 US) Box 5919, New York, NY, USA 10017.

The leading scientific monthly occasionally publishes highly technical but well illustrated articles on microelectronics that are worth searching out. Silicon chip technology is thoroughly explained in the May, 1975, and September, 1977, issues; the superconducting Josephson Junction is featured in May, 1980; and disk storage technology is described in August, 1980.

SOFTSIDE ($25 US) Box 68, Milford, New Hampshire, USA 03055.

A monthly devoted largely to printed games software for the Apple, PET, TRS-80, and ATARI microcomputers. It also contains tips for advanced programmers.

T.H.E. JOURNAL ($20 US) Box 992, Acton, Maryland, USA 01720.

A bi-monthly journal subtitled Technological Horizons in Education, published for school administrators by Information Synergy Inc. of Acton, Maryland. It contains short reviews of new equipment plus five or six erudite articles on the theoretical and practical applications of technological innovations in education ranging from basic literacy to university training. Complimentary subscriptions are available to senior administrators. I recommend it for educational planners and graduate students in education.

MICROCOMPUTING AT SHERIDAN COLLEGE

By Ted Bangay,

Sheridan College of Applied Arts and Technology

At **Sheridan College** we can't claim that we haven't reinvented the wheel in terms of educational microcomputer activities. However, many of our projects are somewhat unusual. This article will outline the microcomputer activities at Sheridan College in areas not normally associated with computers.

Our involvement with microcomputers became serious when twenty-five Commodore PETs were delivered in May 1978. The units were distributed to our major campuses in Oakville and Brampton, and were located in the campus libraries. (Several of the Library staff, far from being intimidated by the 'new technology', enrolled in an evening programming course.)

Initially the computers on the Brampton campus were used by technology students to complete programming assignments and in the analysis of experimental data.

The Oakville PETs were slated for use with a remedial mathematics package developed by members of our faculty and two student programmers. This package, called **MicroMath**, is the foundation of our microcomputer activities since through its use we realized savings in the first two years which offset the hardware cost of the original twenty-five computers. (The software development cost has been recovered through software sales.)

With MicroMath effectively paying for the original computers, we looked for new ways of using microcomputers educationally. Given the lack of quality software at the time, we were forced into developing our own. For this we turned to the faculty.

The faculty, however, were somewhat ignorant of educational computing and required some education. The first faculty workshop was held in the spring of 1979. Despite intensive publicity only a dozen faculty members showed up (together with fourteen presentors!). In the spring of this year, however, there was sufficient interest to offer three one-day workshops to a total of 150 staff and faculty. The second and third workshops were necessitated by the registrations for the first workshop exceeding capacity within hours of its announcement.

One of the faculty members who became 'hooked' right at the outset was a **photography** instructor. Recognizing the graphics capabilities of the microcomputers, he borrowed a PET for the summer and started work on a series of programs in photography fundamentals. Under his guidance a complete package of twelve lessons has been developed. The lessons deal with some of the optical principles of photography. The content is delivered by a combination of text and pseudo-animation on the PET's screen. The photography instructor has branched out into computer graphics, having done some work with a high-resolution PET, an Apple and a Compucolor II. He has also received Ministry approval to offer a program in computer graphics.

Still in the **visual arts**, we use the microcomputers in teaching Art Fundamentals courses. Actually, a generalized multiple choice testing system was developed and Art Fundamentals is one program having made use of this facility. One of the advantages of this testing system is that the order of the multiple choice alternatives is randomized. This tends to reduce the amount of collaboration between students and enhances the individual's learning.

One of the most cost effective packages we have developed is a **music drill and practice system**. This group of programs was developed to improve the skills of our Musical Theatre Production students. Under this system the students listen through earphones to randomly generated musical intervals (eg. octave, perfect fourth, etc.). They then key in the abbreviated interval notation on the PET's keyboard. The computer evaluates the student's response and then replays the interval if necessary. In a one hour period it is possible for a student to be drilled on several hundred intervals. This is in extreme contrast to the traditional method of drilling students on interval recognition: a group of students recording in their notebooks the intervals which are played by a bored, under-utilized (and highly paid) instructor who must then mark each student's work.

Instructors in many programs at Sheridan College are beginning to recognize the importance of **computer literacy**. Several programs include at least one unit using the microcomputers. A typical example is the **Travel Counsellor program**. We have developed an airline reservation system modelled after Air Canada's RESERVAC System. This program, which runs on the PETs, provides the students with an opportunity to interact with a subset of RESERVAC's capabilities, including sign-on and off and reservation protocols. There is no doubt that the skills obtained by students using this system will be attractive to employers.

Software packages are developed during the summer months. Typically we contract with faculty members to design the software using a storyboard approach. Student programmers are hired to implement the faculty members' designs. Currently being implemented are several administrative programs for our Registrar, and packages dealing with sorting algorithms and number systems.

In September 1980 we offered a new two year program called **Microcomputer Management**. This program, which we believe to be the first of its kind in North America, is designed to produce graduates who can exploit microcomputer equipment and software for small business applications. To this end the students take courses in programming, hardware and software evaluation, data base management systems, systems analysis and design, and accounting. We hope to graduate our first class in May 1982.

Another new program is to begin this September. The Microcomputer Technician program will produce technicians for microcomputer troubleshooting, servicing and interfacing. The demand for individuals with these highly specialized skills will grow as industry adopts more automated production methods.

Administratively, we use the microcomputers in several ways. Many Divisions within the College have PETs which function as word processors. In addition, some department budgets and inventories are maintained by microcomputers. In the Library, a microcomputer is used to track our film bookings.

For the last year we have used the Microcomputer Centres during the evenings for **Learning by Appointment**. Under this scheme members of the public are invited to rent time on the machines. No instruction is given, but access to our software library is provided. Although most of our customers have been high school students, many adults use the microcomputers at income Tax time to calculate their returns using Butterfield's famous program.

Several times a year Sheridan College has held workshops dealing with various aspects of microcomputing. Some of the topics dealt with in the past have been educational applications, music generation, business applications, word processing, programming in BASIC and 6502, and a survey of personal computers. These seminars have been very popular. In the future we hope to address topics such as computer graphics, medical applications, and interfacing.

The variety of microcomputer activities at Sheridan College has grown tremendously in three short years. With a cost effective foundation of MicroMath running smoothly, we have managed to explore subject areas not usually associated with computers. Much of the credit belongs to the vision and drive of **Frank Winter** and to the support provided by the senior administration of the College. In the exciting years to come we hope to strengthen Sheridan College's leadership position in educational microcomputing.

Tune up Your Terminals!

By Peter Boos

*Reprinted from the January 1981 **Newsletter** of the Department of Computing Services, University of Waterloo, Waterloo, Ontario, Canada N2L 3G1.*

While enrolled in a computer music course at Conrad Grebel College, University of Waterloo, I became aware of a wide variety of possible music-related endeavours that can be simulated by or assisted by the use of computers. Several of these functions are well demonstrated by the **Keyboard Computer Music** system (KCM) being developed by **Dr. Barry Wills** and other members of the Computers and Music Group in the Systems Design department of the Engineering faculty.

Recently, I visited Dr. Wills, who showed me the Keyboard Computer Music system. Dr. Wills is an accomplished jazz pianist, as well as a Systems Design Engineering professor. Other members of the Computers and Music group, which includes graduate students **Blair Mackay** and **Doug Steele**, have similar inter-disciplinary skills and interests in music production and theory, as well as computer hardware and software development.

The Keyboard Computer Music system, at its simplest level, can be thought of as a very sophisticated keyboard instrument. Input is produced via a velocity-sensitive electronic keyboard, which is then processed within a microcomputer and digital oscillators, producing the corresponding music through an audio amplifier and a pair of speakers.

The potential of the system lies in the storage and manipulation of the sound as digital information. The microcomputer and digital oscillators can be used to produce music which can be represented by an unlimited number of mathematical transformations, or as a simple reproduction of the original input sound. Output can also be produced via a Decwriter II terminal in standard musical notation.

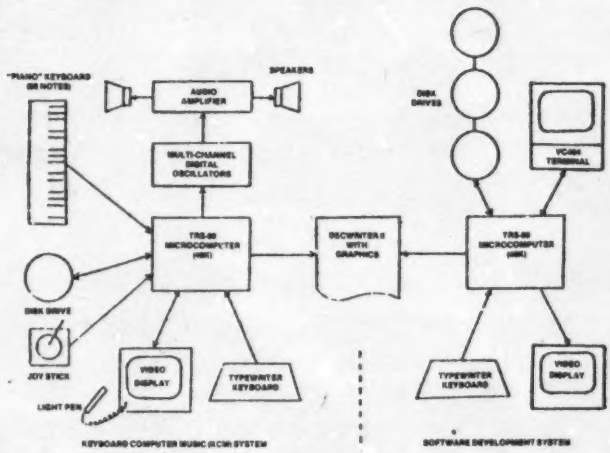
The KCM system lends itself to several other areas of application. Projected uses of the system include:

- a new musical instrument that can be played polyphonically and can create a large variety of sounds under computer control for keyboard musicians;
- a music editing system that can produce common music notation as output for composers, arrangers, and copyists;
- a new system for the analysis of musical style and motifs for musicologists and information theorists;
- a new system for teaching musical concepts such as sight reading, ear training, improvisational skills, etc. for music students and educators; and
- a system for psychoacoustic experiments where the computer creates sound outputs for experiments in a precise and repeatable way for psychologists, acousticians, audio system designers, and recording engineers.

The accompanying figure shows the logical connection between the different components of the KCM system and the associated software development system. The microcomputer, in both cases, is located at the centre of the process. Looking at the KCM system, input to the microcomputer can be received directly from the "piano" keyboard, from files previously stored on disk, or from the typewriter keyboard, or, for interactive applications, with a joy stick or a light pen. Output from the microcomputer can go through the speakers, via the digital oscillators and an audio amplifier, on the Decwriter II hardcopy terminal, on the video display, or it can be stored in files on disk for further processing.

With the software development system, input to the microprocessor can be received directly from the typewriter keyboard, from files previously stored on disk, or from a Volker-Craig 404 terminal. Output can then be produced on the video display, the Volker-Craig 404 terminal, the Decwriter II terminal, or it can be stored in files on disk.

Advantages of these systems include the availability and relatively cheap cost of microcomputers, the ease of use, flexibility and feedback of interactive systems, the minimization of tedious functions for the music teacher, and the appropriateness of a keyboard medium. Overall, the Keyboard Computer Music system is a fascinating development in the use of microcomputers and associated technology, and provides a great deal of promise for the future.



Description of CAI Work in the Language Laboratory

By Rebecca Anders, University of Waterloo

In the **Faculty of Arts Language Laboratory**, the development of computer aided instruction (CAI) has been underway in two different forms: computer aided instruction in French, funded by a grant from the Ministry of Colleges and Universities, and a course authoring programme for microcomputers, funded by a special grant from the MCU.

The French computer lesson development programme launched here at the laboratory in this past year has met with more than moderate success in the time that it has actually been available for student use. The French language lessons for the programme were written to run on the Intecolor 3600 series of microcomputers. Each lesson was designed to present a specific grammar point and contains a set of related exercises. The original objectives set for this first series of lessons, namely to supplement classroom material and to encourage independent study, have been fulfilled and even surpassed. The German Dept. here at the university is currently supporting the creation of several lessons which are to serve grammar review purposes.

To facilitate lesson generation for the author, a Front-end package of the most needed sub-routines was written. A full-screen editor, AGILIS, which processes lines on the screen to memory in BASIC code, also served to be invaluable to the lesson author. In this way, lesson design could be left entirely to the creativity of the individual author.

The most recent project currently in progress here in the language laboratory is a course authoring system, which will allow courseware authors to write CAI programmes in a language that is common to more than one microcomputer. The target computers are the APPLE, RADIO SHACK and Intecolor 3600. The developed courseware will run under an operating system and programming language that is available to all of the above-mentioned machines.

This programme will be able to create lessons, working almost entirely on prompts to the author. The finished product will be a comprehensive package complex in interior design and extensive in question analysis. As the Intecolor lesson generation necessitated a "Front-end" package, this system will contain a "CORE" package of routines which will control the various technical aspects of the project. The ultimate goal of this authoring system is to take on the role of "pseudo-author", thus leaving only the basic framework of lesson creation and data entry to the author.

society for research into higher education

limited

at the University Guildford Surrey GU2 5XH

The **Society for Research into Higher Education** is a learned Society with individual and corporate members in many countries. Once of its main activities is specialist publishing. We have strong links with Canada, and even when the pound was high, a solid core of members. They have appreciated our 6-times-a-year **Bulletin** and some have used it to plan study leaves and vacations by putting in a (free) notice of their plans. Institutions have appreciated the free publicity for their conferences. Others have appreciated receiving our free publications, especially **Abstracts** and cheap subscriptions to our journal **Studies in Higher Education.** They also buy our research monographs with one-third discount and, thanks to our distributor friends in Guelph, at a nicely bankable rate.

Major new study

There are now two new reasons why the Society will be more interesting to Canadians. One reason is our **Study of the Future of Higher Education in Britain**, the first comprehensive review since Robbins. Finance for the review comes mainly from the Leverhulme Trust (hence it is often referred to as "Leverhulme") with help from the Gulbenkian Foundation and the British Government's Department of Education and Science (DES).

The Study

The Study will be wider ranging than Robbins, on both sides of the famous Binary Line, considering the new Polytechnics and Colleges of Higher Education, and many other institutions including of course the Open University, and probably the proposed Open Tech. It will also be more interested than Robbins in curriculum and teaching methods.

Methodology

The methodology is new: a step by step dialectic between specialist and generalist in a structured national debate. The first step was for a group of the Society led by **Professor Gareth Williams** of Lancaster University to identify the broad areas, (they found eight) and then to pinpoint the key issues in each area. Step two was to identify scholars specializing in each of the key issues, and to commission them to review and focus the significant research results bearing on that issue. Step three (which is continuing) was to choose a wider group of specialists in each broad area who could meet to discuss the research reviews with leading employers, journalists, government officials and others in a series of seminars spread over two years.

Step four and five run in parallel. The journalists publish reports of each seminar: some pretty randomly. But the London **Times Higher Education Supplement (THES)** is publishing to a highly structured format with a summary of the reviews, a report of the discussion and a blunt commentary. Meanwhile, step five, the convenor of the seminar writes an academic report, the authors polish their reviews and the Society rapidly publishes the book of the seminar in time for step six, a National Conference. The first of these, on "Higher Education and the Labour Market", is being organized by the education correspondent of the London **Economist** and will bring together a wider audience, including interest and pressure groups. Later conferences will be convened by leading educationalists.

There will be press coverage and maybe some publications for each conference. So by the time the nine main areas have been covered by seminar, public discussion and conference, the issues will have been well aired. Step seven in early 1983 will be to get all this together with summaries, a seminar to formulate recommendations, THES splash and a final national conference. So when British tertiary education begins to emerge from the tunnel, a lot of thinking and a real national debate will be behind us. As a way of planning higher education it will have been very different from Robbins — more participatory, less directive. Less expensive, too. It will have been as British as Robbins; but have more food for thought for a British-related system, for the British scene of 1981 has more in common with Canada than the British scene in 1961.

Publishing

SRHE will publish the core of all this, the 10 books of the 9 seminars. (The Teaching Function and Curriculum Development seminar will put out two volumes). They can be ordered in advance (up till 30 November 81) at a fixed price including postage of $C90. Supplement for airmail $C42.

The titles (which will be a bit punchier on the spine) are:

- Higher Education and the Labour Market
- Demand and Access
- Institutional Adaptation and Change
- The Research Function
- The Teaching Function (2 monographs)
- The Fine Arts
- Mechanisms of Finance
- Structures and Governance

Second Reason

The second new reason that might interest a Canadian in SRHE is short and sweet:

The £ has collapsed.

We offer membership for our fiscal 81/82 (1 October to 30 September) at a special $Can. rate, like this:

Individuals	$C50
Retired people, students	$C20
Institutions with less than 1,000 students	$C140
Institutions with 1,000 - 3,000 students	$C210
Institutions with more than 3,000 students	$C300

For individuals, the normal cost of the free publications about equals the subscription, and any other purchases make a profit.

Details, membership forms, book catalog, National Study orders, from SRHE at the University, Guildford, Surrey GU2 5XH, England.

Editor's Note: The Office for Educational Practice at the University of Guelph offers many of the SRHE publications for sale. For further information and/or a catalogue contact: Ian Easterbrook, Office for Educational Practice, University of Guelph, Raithby House, Guelph, Ontario N1G 2W1 (519-824-4120 ext. 3106).

MICROCOMPUTERS AND HIGHER EDUCATION: A SELECTIVE ANNOTATED BIBLIOGRAPHY*

Janette M. Baker (compiler)
Educational Development Office
York University
August 1981

(I) Books and Articles — General Information and Applied Applications

AEDS Journal 13, 1 (Fall 1979): Entire issue on "Microcomputers: Their Selection and Application in Education."

This special issue contains sections on the impact and role of microcomputers in education, selecting a microcomputer, software development, and microcomputer applications.

Baker, Frank B.; Ratanakesdatan, Peeropong; and McIsaac, Donald, N. "A Micro-computer Based Test Scoring System." **Educational Technology**, 18, 2 (February 1978): 36-39.

This article describes a stand alone test scoring system using software designed by professional programmers.

De Laurentiis, Emiliano. "Learning by Interactive Programming: Microcomputer Applications." **Educational Technology** 20, 12 (December 1980): 10-14.

After reviewing major concepts associated with computers, De Laurentiis suggests possible educational uses for microcomputers.

Educational Technology 19, 10 (October 1979): Entire issue on microcomputers.

This issue examines microcomputer technology and the implications, for educational practice. There are not only 10 relevant articles, but also a glossary of computer-related terms, a list of microcomputer manufacturers and a selected list of persons and centres active in microcomputer usage in education.

Gleason, Gerald T. "Microcomputers in Education: The State of the Art." **Education Technology** 21, 3, (March 1981): 7-18.

Gleason gives his perspectives on CAI and microcomputer applications. There are rapid improvements in hardware. An accelerating pace in the development of software can be expected. A major task for educators will be teaching computer literacy.

Huntington, J.F. "Microcomputers and University Teaching." **Improving College and University Teaching** 28, 2, (Spring 1980): 75-77.

This article outlines the advantages and limitations of using the BASIC language on microcomputer systems for CAI and CMI. A comparison of the PET, APPLE II and TRS-80 is included.

Learning Resources Bulletin (Middlesex Polytechnic) 4, 2 (April 1980): Entire issue on microcomputers in education.

Articles include a description of a multidisciplinary course in microelectronics, an analysis of microcomputer uses in secondary education, educational applications, and supporting computer based learning.

Lewis, R. and Tagg, E.D. (Eds.) **Computers in Education**. Amsterdam: North-Holland, 1981.

The proceedings of the 3rd World Conference on Computers in Education contains about 100 papers on computer use around the world, as well as summaries of panel discussion participants' positions. The most recent and comprehensive compilation of worldwide activity in the area.

Licklider, Tracy R. "Calling Information: Telecomputing with Personal Computers." **Creative Computing** 7, 4, (April 1981): 78-81.

This article provides an excellent introduction to the use of a microcomputer as an information utility. The author discusses telephone hookups to large information retrieval systems using MicroNET and The Source and gives the advantages and disadvantages of each. Information available includes the Dow-Jones averages, the UPI news service, a list of restaurants in New York, genealogical information from Virginia, etc. CBBS (computerized bulletin boards) and electronic mail systems — what can be done now and what needs to be developed — are also discussed.

Proceedings of the Third Canadian Symposium on Instructional Technology. Ottawa: National Research Council, 1980.

The Third Canadian symposium has many papers reflecting Canadian work in computers in education, although not all on microcomputers. Three of the articles are listed below:

Burns, R.E.; Davisson, W.I.: and Kline, E.A. **"CAI and the Microprocessor."** pp. 347-353. *This paper describes the development of CAI using microcomputers at the College of Arts and Letters at the University of Notre Dame, Sound Bend, Indiana, with specific information about its use in remedial English.*

Gerhold, G. and Kheriaty, L. **"Recent Developments in Micro-Based CAI"** pp. 117-120. *Gerhold and Kheriaty describe a CAI system which uses a microcomputer. They also report on their method of educating teachers to program CAI using the COMMON PILOT language. The article refers to the secondary school level; but the information is also relevant to the postsecondary education level.*

Maguire, R.B. and Thomas, D.R., **"Microcomputer Technology and Distance Education: A Contemporary Application."** pp. 327-332. *Maguire and Thomas report on management education training provided by the University of Regina to Inuit and Indian students living in the Northwest Territories. The programme uses commercially available microcomputer hardware to provide an "electronic blackboard" for students linked to their instructor solely by a telephone line.*

Reed, Robin. "Selecting a Microcomputer." **Bulletin of Educational Research** (Newcastle Upon Tyne Polytechnic) no. 21 (Spring 1981): 12-16.

This short article gives some reasons why a department might wish to buy a microcomputer and provides a checklist for microcomputers.

Rusby, Nicholas John. **An Introduction to Educational Computing.** London: Croom Helm, 1979.

This book, while not directly about microcomputers, provides an excellent introduction to the use of computers in education. It is about computer assisted learning — what it is and how to use it; computer managed learning, informatics, and the technological aspects of computers. There is also an annotated bibliography and a glossary.

Sledge, Duncan (comp.). **Microcomputers in Education.** London: Council for Educational Technology, 1979.

The articles provide a general introduction to the subject and cover such topics as the nature of the computer, its management and uses, types and compatibility of equipment, various programming languages, and the availability of software.

"Special Report: Microcomputers in Higher Education." **Times Higher Education Supplement** 18 July 1980, pp. 17-21.

A collection of articles about issues and applications.

Strang, Harold R. "Microcomputers and Academic Grading." **Educational Technology** 20, 10, (October 1980): 58-59.

The use of a microcomputer to store and process student grades quickly and economically is described.

Thorvaldson, P. (Ed.) **From Books to Bytes: The Impact of Technology on Education.** Toronto: Ontario Educational Communications Authority, 1980.

This is an interesting general reference on educational issues, prepared for the TV plenary session of the Ontario Association for Curriculum Development. It contains good articles on the why's and hows of computer use, including several Canadian examples, two of which follow:

Aiken, Robert M. and Braun, Ludwig. **"Into the 80's with Microcomputer-based Learning."** pp. 42-47. *Aiken and Braun list a number of educational applications for computers, then discuss what educators should do if the computer is to be introduced into the classroom in the most effective way. Finally, they describe some tools to measure the impact microcomputer systems will have on education.*

McLean, R.S. and Olivier, W.P. **"Computer-Assisted Learning in Ontario."** pp. 62-68. *This paper describes a 10-year program of development of CAI courseware undertaken cooperatively between the Ontario Colleges of Applied Arts and Technology and the Ontario Institute for Studies in Education.*

Zinn, Karl L. "Using the Microcomputer: One University's Experiences." **Educational Technology** 19, 11 (November 1979): 54-55.

The current educational applications with a variety of microcomputers (PET, TRS-80, APPLE, OSI, Altair) at the University of Michigan are described.

(II) Bibliographies

Goldberg, Albert, L. "A Beginner's Guide to Microcomputer Resources." **Audiovisual Instruction** (November 1979): 22-23.

A list of books, journals and manufacturers to help the novice learn about microcomputers.

(III) Discipline - Specific Information

(a) Botany

Yates, David. "LEAFSIM: A Computer Simulation Model for Botany Students." **Newsletter** (University of Queensland, Tertiary Education Institute) no. 4, (September 1979): 3-4.

LEAFSIM, the interactive computer system described in this article, lets students who have a basic knowledge of the theory of leaf-environment relationship examine and study simulated 'real life' situations.

(b) Chemistry

Butler, William M., and Griffin, Henry C. "Simulation in the Chemistry Laboratory with Microcomputers." **Journal of Chemical Education** 56, 8, (August 1979): 543-545.

This paper describes the way the PET computer is used at the University of Michigan to supplement in the laboratory the regular "wet" experiment. The computers are used for direct simulations, partial simulations and analysis, chemical games and animation. CAI is also available for students who experience difficulty in general chemistry laboratory work.

Gerhold, George, et al. "Bits, Bytes, Boards, Buses and Beyond: A Chemist's Introduction to Microprocessors and Microcomputers." **Journal of Chemical Education** 56, 11 (November 1979): 701-706.

This paper gives a general introduction to micro- and minicomputers. The components of the microcomputers are discussed in detail. Information about available software is included.

Moore, John et al. "Computer-Aided Instruction with Microcomputers. Part I: Systems and Applications." **Journal of Chemical Education** 56, 12 (December 1979): 776-783.

Microcomputer systems that are suitable for CAI are described. The authors outline specific instruction applications to illustrate the variety of systems available and their adaptability to problems faced by chemistry instructors.

Moore, John et al. "Computer-Aided Instruction with Microcomputers. II: Systems and Applications, Comparison and Evaluation." **Journal of Chemical Education** 57, 2, (February 1980): 93-99.

This article completes the description of microcomputer systems and applications which began in the December 1979 issue. The authors also compare the features of the various systems.

(c) Computer Science

Gale, Douglas S. "Integrating Microcomputers and Microelectronics into the Physics Curriculum." **American Journal of Physics** 48, 10 (October 1980): 847-849.

This article describes an interdisciplinary microcomputer and microelectronic program which operates at the graduate and undergraduate levels in Physics and Computer Science Departments at East Texas State University.

(d) French

"Computer Assisted Learning in Introductory French at the University of Waterloo." n.d. (Mimeographed).

This paper describes the use of microcomputers in a series of introductory French lessons.

(e) Music

Hofstetter, Fred T. "Microelectronics and Music Education." **Music Educators Journal** 65, 8, (April 1979): 38-45.

Hofstetter lists the ways in which computer technology can be used to improve music instruction with examples of computer based learning materials developed by nine major universities. He also provides information about five stand-alone microelectronic music systems. His sections on further sources of information include names of journals and newsletters, a mention of the National Consortium for Computer-Based Music Instruction and a list of relevant articles.

(f) Physics

Gale, Douglas S. "Integrating Microcomputers and Microelectronics into the Physics Curriculum." **American Journal of Physics** 48, 10 (October 1980): 847-849.

This article describes an interdisciplinary microcomputer and microelectronic program which operates at the graduate and undergraduate levels in Physics and Computer Science Departments at East Texas State University.

Tinker, Robert F. "Microcomputers in the Teaching Lab." **Physics Teacher** 19, 2 (February 1981): 94-105.

This article describes a variety of uses for the microcomputer — both general applications and programs tailored to specific needs of certain laboratory experiments. Tinker also discusses some considerations to keep in mind when selecting a computer for laboratory use and the educational implications of using a computer in the lab.

(g) Science

Hubin, W.N., "The Microcomputer in the Undergraduate Science Curriculum." **Byte** (July, 1980): 174-192.

Hubin gives some of the current uses of microcomputers in science education and describes a microprocessor interface project for the student laboratory.

* *Copies of these articles and books are available in the Resource Centre for the Educational Development Office, York University.*

BEYOND COMPUTER LITERACY

By Ronald G. Ragsdale, The Ontario Institute for Studies in Education

ABSTRACT

The location of instruction about computers has been moving from the graduate school level to earlier levels of instruction. The rate of movement has been accelerating and much of our introductory instruction about computers may soon be in elementary schools.

The existence of computer-sophisticated students in elementary and secondary schools, along with an abundance of computers, should have marked effects on the work that is done in those schools. When these students move on to post-secondary institutions, the impact may be even greater. This paper proposes a line of investigation that would help the educational system prepare for computer-literate students.

INTRODUCTION

The search for a comprehensive definition of computer literacy, the definition of programs to ensure that literacy is acquired, and the attempts to validate existing programs are continuing. The purpose of this article is not to support a particular definition of computer literacy, or training programs. The following introductory paragraphs are, instead, an attempt to put these developments in a (somewhat arbitrary) perspective in order to move our thinking from the short term, current-context approach to a longer view of the problem and the information that may be required to deal with it.

The acquisition of computer literacy, however defined, has not only become increasingly important, but has also been changing in terms of the age level at which it is usually acquired. The changing proportion of computer-literate people is having an important effect on our lives, but the changing age level at which one becomes computer-literate will also have an important effect. This will be particularly true for those institutions which move from the position of providing literacy instructions to that of receiving literate students, or in the words of the title, as those institutions move "beyond computer literacy."

Only twenty years ago, the primary location for training in computers was in graduate schools of larger universities. In many instances the "university computer" was used by an individual, or in the case of students having a laboratory session, a small group for a one or two hour period. We shall call this period when much of the information about computers and computer skills was imparted at the graduate level, **the first era of computer literacy**.

Throughout the 1960s this mode of operation changed so that in most universities there was greater access to computing services and most of the training in the use of computers took place at the undergraduate level. This time of mass undergraduate instruction can be called the **second era** of computer literacy. In some institutions, with **Dartmouth College** being the earliest example, there was widespread access to time-sharing services, but in most cases it was batch access. However, it is important to note that even though there is a great deal of instruction about computers and their use at the undergraduate level and this has been true for a number of years, graduate schools still find that most of their students have not had prior training in computers. Thus, it is still necessary for the graduate schools to provide training opportunities where these skills are required.

Within the past few years the pace has quickened and greater numbers of students now acquire computer knowledge and skills at the secondary school level, heralding the beginning of the third era of computer literacy. The increase is still not large enough to have a great effect on the amount of training that universities must provide at the undergraduate level, but the rate of growth in the use of microcomputers is so great that a change is likely to occur soon. Initially, the change in student abilities (for undergraduate university students) will probably be in the form of greater variability of the amount of computer expertise. When microcomputers become so prevalent in secondary schools that all students acquire computer skills, the variability should decline. During this era the role of the undergraduate computer science department will change from a vendor of elementary skills and knowledge for masses of students, to a vendor of specialized skills for smaller numbers of students. This change will signal the end of the second era of computer literacy which will have had a life of about twenty years.

The **third era of computer literacy** will be much shorter; in fact, it may never occur. At the beginning of this era the secondary schools will be setting up programs which will impart basic computer skills and knowledge to their students. Very quickly however, perhaps even before the programs are completely in place, the need for them will decrease due to the increasing computer sophistication of those students entering secondary schools.

In **the fourth era**, we presume that computers will be at least as common as cassette recorders in the elementary classroom so that courses on the uses of computers will be as uncommon at higher levels of instruction as courses on cassette recorders are now. By this we mean that all students will, by the time that they leave elementary school, be able to operate microcomputers, be familiar with their applications, and (most of them) be able to write some programs. As mentioned earlier, this will have some effect on the course offerings at the higher level, namely that the introductory computer courses will become redundant. More important however, is the impact that computer-sophisticated (or "new") students with access to computers will have on the curricula of the secondary schools and universities, to say nothing of the elementary schools themselves. We suspect that the new students will be different in important ways and that their courses should also be different. Information about these differences and their effects would enable us to implement the proper changes before the new students arrive, creating a true computer revolution, not a prolonged computer evolution.

ASSESSING THE IMPACT OF COMPUTERS

Although we may feel confident that the introduction of computers in education produces important changes in students, it is not always easy to demonstrate that this is true, or to determine what the changes are. We find that there are particular problems in obtaining convincing evidence that demonstrates the difference between computer users and non-users. The primary cause of this difficulty is our inability to collect evidence that is both internally valid and externally valid.

"Internal validity" and "external validity" are terms which are usually applied to experiments (Campbell & Stanley, 1963). Internal validity has to go with the control of experimental conditions and the answer to the question, "Did the treatment (computer) cause the observed differences between the two groups?" Therefore, internal validity deals with both the initial comparability of groups as well as their comparability of experience over the course of the experiment.

External validity has to do with the generalizability of the results of a particular study, or "Can we expect to find the same results if the treatment (computer) is applied to other groups?" Unfortunately, an increase in one of these types of validity is usually accomplished at the expense of the other. If we maintain rigid control over the experiences in the experimental and control classrooms, we are likely to create such an artificial environment that it will be difficult to generalize the results to any other situation. On the other hand, if we try to maintain a natural environment in the two classrooms, we will not be able to eliminate the possibility that some "natural" event (field trip, new books, film program, etc.) has been responsible for a difference between the groups.

THE CURRENT NEED

Fortunately, an experiment is not what is required in this instance, since we do not need to know how the computer sophisticated students will differ from other students. Our more important goal is to know as much as we can about these new students (descriptive, rather than inferential information) and what changes the schools will have to make when these students appear in large numbers. Our present approach to this program is evolutionary in that we are introducing computer knowledge into the elementary

school curriculum when it becomes obvious that changes are required. The curriculum change process would be much more effective if we could determine the characteristics of the new students before they arrive. In essence, we need to be able to accelerate enough students into the future so that one or more secondary schools will obtain the experience of dealing with the new students.

A PROPOSED INVESTIGATION FOR SECONDARY EDUCATION

The general plan of the investigation is to select a relatively isolated school board where a few elementary schools feed into one secondary school. In this setting we would want to provide all of the elementary school students with computer skills and knowledge and provide the secondary school with computer resources. These physical resources would be supplemented by human resources, who would provide the teachers with skills and knowledge for using the available technology. Finally, there would be considerable data gathered from students, teachers, administrators, and parents.

A relative abundance of microcomputers is necessary for this investigation, but not sufficient to ensure its success. At least two teams of specialists must be involved to maximize the utility of this effort. One team would help the teachers obtain the maximum benefit from their new equipment. They would help the teachers become familiar with the micros, acquire programs that are already available, help them modify programs to suit their needs, and help them create their own programs where necessary. Throughout the course of the study, they would keep teachers informed about developments that might help them use the micros more effectively. This team would also, in conjunction with the teachers, define the knowledge and skills that would be imparted to the students. The importance of this team is worth restating, in that the look into the future is only partly accomplished by the acquisition of (present day) hardware. If we are to obtain insight into future uses and effects of the hardware, users (teachers) must be given extra assistance to compensate for their lack of experience and the scarcity of easily obtained curriculum packages.

The second team would collect information about the students, teachers, and others involved in the study. For the most part, they would operate independently of the members of the first team; they would not restrict their investigations to effects which the first team hoped to achieve. Their methods of investigation would include ethnographic approaches and we cannot predict all the types of information they would collect. There are, however, some types of data that are very likely to be included.

The general spirit of the data gathering effort would contain a strong component of "side-effects analysis" (Scriven, 1979) which has some similarity to Goal-free evaluation (Scriven, 1972); this would direct strong attention toward the unanticipated effects of the experimental treatment. This means that the data collection must be somewhat open-ended and suggestions regarding the types of data to be collected should be solicited from a variety of sources. The study of side-effects may be an important source of information since the focus of the investigation should be on the changes that computers will bring to the education process, not just those changes that are anticipated by the opponents and proponents of computer use.

THE POST-SECONDARY INVESTIGATION

The post-secondary investigation would have to take a slightly different form, since a post-secondary institution does not receive its students from a small number of schools, nor is it controlled by the same authority that controls the secondary schools. Therefore, since the college/university could not be assured a homogeneous group of computer literates, a case study approach would have to be used. To maximize the value of the study, it should be conducted at a large number of institutions, involving computer-literate students from as wide a variety of backgrounds as possible. The selected students, provided with ample computing resources, should interact within, and be studied by, staff members from a wide variety of disciplines. The data collection would again be oriented towards unanticipated effects, with open-ended and eclectic methods being used.

The purpose of the study is almost identical to the secondary investigation: Discover how (if) the computer-literate students differ from non-literates and how (if) these differences can be used to make them more effective learners. Thompson (1979) suggests that developments in information technology could have an impact similar to the effect the phonetic alphabet had on early Greece. This effect, as described by Havelock (1963), was to free individuals from the task of preserving all information in their own memories, and allowed them to devote more time to such activities as analytical criticism of their own behavior. If a change of that magnitude is going to occur, we need to identify its effects as quickly as possible.

The decision that we face is a choice between a continued "coping" with piecemeal change or a planning process that is based on an informed estimate of the changes that are likely to occur. The choice that is made will help determine the effectiveness of the education system for the remainder of the twentieth century.

References

Campbell, D.T., and Stanley, J.C. **Experimental and Quasi-Experimental Designs for Research.** Chicago: Rand-McNally, 1963.

Havelock, E.A. **Preface to Plato.** Cambridge, MA: Harvard University Press, 1963, cited in Thompson (1979).

Scriven, M. "Pros and cons about goal free evaluation." **Evaluation Comment** 3 (1972): 1-4.

Scriven, M. Personal communication, December, 1979.

Thompson, G.B. **Memo from Mercury: Information Technology is Different.** Occasional paper No. 10. Montreal: Institute for Research on Public Policy, 1979.

BOOK REVIEWS

MINDSTORMS: CHILDREN, COMPUTERS, AND POWERFUL IDEAS
by Seymour Papert
New York: Basic Books, 1980 pp. 230 $12.95 (U.S.)
Reviewed by R.S. McLean, Ontario Institute for Studies in Education

Reprinted from **ECOO Newsletter,** Volume 1, Number 5, December 1980, published by the Educational Computing Organization of Ontario.

The analogy that computers are to minds what engines are to muscles is an intriguing idea that has been with us for some time. Certain comparisons tend to support the idea that the computer has advantages for some types of mental activity, in the way that the jet is superior to legs, for certain purposes. But the comparison has always seemed most valid in its raw power formulations. The idea of a "mind multiplier" has not yet gained currency in education.

Perhaps we have taken too short a perspective. Computers have not been with us very long, and there haven't been extensive studies of the effects that having a computer as a normal part of one's life might have on the ways in which one thinks. Following the industrial model, we tend to think of computers as simply doing the same old things faster and more efficiently.

Seymour Papert suggests that it can be otherwise, that computers could be used to remold the world in which we grow up so that learning "difficult" concepts would be easy — in fact, fun! How is this magic accomplished? Perhaps it is easily grasped by analogy. For us, learning to speak French is difficult — we have to go to special classes in school for years and obtain only a rudimentary ability to speak the language. On the other hand, children who grow up in France have no trouble at all, even without any schooling! The answer is obvious! we have little trouble learning what is a natural part of our environment and is useful in it in our terms.

Children learn a lot about the world around them, on their own. The world is full of concrete representations of things, so it is little surprise that children are characterized as having concrete reasoning in their early years. The Swiss psychologist, **Jean Piaget**, has pointed out these developmental stages. Considerable effort is expended in developing educational materials to be sure that children's abstract capabilities are not called upon until they have reached the abstract stage. Research has demonstrated, the world over, that before that time, abstract concepts cannot be learned!

Starting with Piaget's work, Papert suggests that the stages are not immutable, but a function of the environment. The world is normally concrete and becomes abstract only with great difficulty and experience. But we can now use computers to create "microworlds" for children. It is now possible to provide a "Mathland" that does for mathematics what "Frenchland" does for the learning of French.

Microworlds are environments where children can play and learn naturally, as they do in the normal environment. But these environments naturally involve mathematical concepts, some of which are abstract notions currently saved for university education. A radical idea, that — children can have fun doing things that university students find difficult! On the other hand, children do concrete things now that have similarities to adult concrete activities: compare building construction to play with a Meccano set, for example. In this concrete analogy, the child's materials and results are different from the adult activity, but the child still learns many of the concepts of the adult's world. Children don't learn the abstract adult world by this means beause there hasn't been a way to make these abstract concepts "child's play".

Computers can give abstract ideas a behavioural reality, and Papert describes 15 years of research developing such environments for young children. He describes his work with **LOGO**, a computer language that can be used by children which also embodies some rather advanced facilities more characteristic of artificial intelligence research. Coupled with appropriate human guidance, the computer systems he describes provide a way for children to use powerful information tools to learn problem solving and thinking skills that we would class as quite advanced. Nor are such skills limited to mathematics: he makes the case for their applicability in seemingly unrelated activities like juggling, skiing and bicycle riding.

The basic approach might be described as activities that lead to results approximating outcomes children wish to obtain for their own reasons. Each outcome which is not exactly the desired one is viewed as a partial result that can be fixed, rather than simply wrong. This simple approach to problem solving is easy to speak of, but it seldom seems to inform our current educational practice.

This book suggests not only a new way of thinking about computers in education but also a new way of thinking about education itself.

It is unlikely that Papert's version will be adopted, yet it offers an outstanding glimpse of fundamental advances that could be made in education as a result of our new intellectual technology. Such advances take more than technology: they must be founded on sound educational theory. Papert has spelled out the beginnings of that theory.

Papert fears that widespread adoption of computers in education for present applications may exclude the revolution he proposes. He may be right: the revolution may occur only in some private schools, or perhaps in the homes of progressive families. Although Papert would maintain that there is little use in partial adoption of his ideas, I hope they will come to influence our applications of computers in education and that some of his ideas can be adapted.

We really do deserve to develop a world in which the linkage indicated in the subtitle — children, computers and powerful ideas — can be obtained, through computers in education.

GUIDE TO MICROCOMPUTERS by Franz J. Frederick. Washington, D.C.: Association of Educational Communications Technology, 1980. pp. 160. $11.50 (U.S.)

Reviewed by Susan E. Moont, George Brown College

INTRODUCTION

The catalog for Information Resource Publications describes the book as 'An "everything you wanted to know about . . ." guide to microcomputers, including computer languages, operating systems, compatible systems, special accessories, time sharing, service and maintenance, potential instructional and media center applications, and an extensive list of resources'. Although aimed at the educational technologist it is suitable for any educator with an interest in incorporating computers in the instructional setting. The text varies from quite simple explanations to the necessary technical details associated with microcomputer use.

BIASES STATED:

Before beginning the comments pertinent to this book of 160 pages, the reviewer would like to set out two biases related to publications about computers and education.

It seems that the topic is always tackled back to front. The computer-centred sections are printed first, with the educational applications following. Ideally, we should begin with the needs and problems of the student, and the educational system, with the relevant computer applications being supplied after this.

Secondly, greater effort should be applied to discriminating among the topics in computers in education. The grossest division occurs between student and administrative uses. Not being as concerned with administrative uses, I see the next and most important distinctions as being among:

1. Computer Studies — the study of computers for a career,
2. Computer Literacy — the study of the way computers affect, and are used by, the general populace, and
3. Computer Based Learning — the use of computers for individualized learning in any educational setting.

There are many who would argue that there are clear cut lines between the elementary, secondary, college and university levels. When one considers that gifted elementary students can be working on university level material through the use of a computer, the lines begin to blue. They waver further when one considers that all students from about grade one on can make use of a word processor to aid in writing activities.

OVERVIEW:

This book is a joint effort between the **AECT** — Association for Educational Communications and Technology, and **ERIC** — Educational Resources Information Clearinghouse. Although there are many resource lists included it is disappointing that a selection of the best of ERIC documents related to the topic was not included. Since the field of computers is so rapidly changing, and because computers in education is (currently) such a specialized field, it is often difficult to find meaningful readable information. ERIC is a very rich resource in this regard.

The chapters cover most of the topics relevant to microcomputers in education. Hardware (the actual microcomputers themselves) and software (the programs to make the computers work) discussions are confined to the main types of machines which are

in use in educational settings now. Both current and future applications are discussed. It is a pity that the book isn't fatter: interesting tidbits of information are often introduced with no explanation.

One must be wary of some of the lists of resources, particularly in the area of software applications such as word processors and data base managers. Even though the publication date is 1980 this is a long time for the area of microcomputers. Actually, it is better not to rely on books for this type of information but to go to manufacturer's catalogs, user group newsletters, magazines, and computer consultants.

One problem about this book is that it does not indicate that there is a difference between SOFTWARE and COURSEWARE. Software is the programs that make a computer run. It can also refer to many types of business packages. However, when a computer program is actually used to teach something it is referred to as courseware. Often courseware will come packaged with teacher and student manuals.

The book is totally American and does not include any sources of Canadian courseware or software such as MERLAN SCIENTIFIC, a Canadian company, that produces good Physics courseware. Nor does it mention the Commodore Business Machine Company, a firm started in Toronto as a typewriter store on Yonge Street.

One last statement must be made before addressing specific sections. The book has only recently come into the hands of the reviewer and so any comments made are not related to long term use.

SPECIFIC COMMENTS:

The first six chapters of the book address the actual microcomputers themselves with a short explanation of terminology. A point well made is that care must be taken in microcomputer and peripheral (the things that are used with microcomputers, such as printers, disc drives, joysticks and paddles, and lightpens) selection because different standards exist among the different manufacturers.

Although this section is quite technical I would suggest that anyone new to the area of microcomputers read it before making a purchase. The information contained in the chapter *"What's In A Microcomputer System"* is the minimum amount of knowledge needed to make an informed decision.

Tony Webster's **Microcomputer Buyer's Guide.** Los Angeles: Computer Reference Guide, 1981 provides more in-depth supplementary reading to this section.

The next five chapters discuss several specific applications of microcomputers in the classroom with enough range to give a good view of the field.

I would like to take this book to cocktail parties to deal with the inevitable question "Computers in education, what's that all about?". Chapter 10: *"Microcomputers in Education"* provides the perfect answer. It sketches eleven examples of existing projects that show a variety of applications.

One of the best chapters in the book, Special Applications, offers concise but clear descriptions of the future of the technology — videotext, electronic mail, access to information bases, and videodiscs.

The last three chapters specifically contain resource lists although there are more sprinkled through the sections already discussed. The list of journals and magazines is quite complete. The now defunct magazine **Calculators/Computers** is included but this is a problem with any list of journals and magazines in the field. Many of these magazines can be found in university bookstores, and bookstores with an extensive magazine collection. **Creative Computing** is perhaps the most popular and probably the easiest to start reading. **The Computing Teacher** (Computing Center, Eastern Oregon State College, La Grande, OR 97850) is available only by subscription, but is worth getting for the simple way it deals with the topic. Although **The Computing Teacher** leans to the school level it has an Arts and Humanities Column which is applicable to higher education.

The chapter on sources for Computer Languages is definitely for the well informed. However, this is about the only place that I have seen a list like this. For instance, two sources of FORTRAN are listed (there are more than this now), three sources of LISP, and two pages of sources for microcomputer PASCAL.

The last chapter tries to cover available books, program guides, and sources of educational programs. Unfortunately, it is impossible to do this well in one short chapter. Many useful references are interwoven with not-so-useful ones and some good books, published recently are naturally missing. This chapter is handy if you take it to an experienced person and ask him/her to mark the type of material you are looking for.

One particularly disturbing feature about this chapter is the lack of information on software (actually, courseware is correct in this case) sources. CONDUIT and MECC are in the same list. MECC — Minnesota Educational Computing Corporation deals with school courseware while CONDUIT is the best known source of undergraduate courseware. The CONDUIT newsletter **Pipeline** (University of Iowa) provides in-depth articles as well as news of courseware releases.

CONCLUSION:

It is hard to know whether to recommend this book or not. It is the sort of reference book that is good to borrow from somebody else's shelf but I don't know if I would pay to sit it on mine. I think it would be an excellent book to put in a library if somebody could mark the material that is up to date and relevant.

The saying "Buyer Beware" applies to all areas of microcomputer use. Buy this book and use it, but also look at whatever you can get your hands on. One day, you may be able to write the definitive book on Computers in Education.

RESOURCE MATERIALS

MICROCOMPUTER CLEARINGHOUSE

Products will be available soon from the newly created **MicroSIFT** (Microcomputer Software Information for Teachers) program established by the Northwest Regional Educational Laboratory, 710 S.W. Second Avenue, Portland, Oregon 97204. The new clearinghouse will emphasize computer software at the pre-college level. The program is being funded by a grant from the National Institute of Education.

TEACHING ASSISTANCE NOTES

The **Instructional Development Centre** at **McMaster University** recently published the first issue of **Teaching Assistance Notes** offering news and information about who is doing what in the orientation and development of teaching assistants. The excellent summaries are an outgrowth of a Canadian wide survey. For further information contact: Dr. A. Blizzard, Director, Instructional Development Centre, McMaster University, Hamilton, Ontario L8S 4M1.

TEACHING WITH CASES

The **School of Business Administration, University of Western Ontario** have recently published **Teaching With Cases** by **James A. Erskine, Michiel R. Leenders,** and **Louise A. Mauffette-Leenders** as a follow-up to the authors' earlier and successful Case Research — The Case Writing Process. It covers the full spectrum of topics related to case teaching and identifies a wide array of views and styles. Cost: $16.50 plus $2.50 postage and handling. Available from: Research and Publications Division, School of Business Administration, The University of Western Ontario, London, Ontario N6A 3K7.

COMPUTER COURSEWARE

Education Technology now carries several regular columns related to media and its use in education. Of particular interest is the column Computer Courseware which offers brief descriptions of software including costs and availability.

COMPUTER SOFTWARE FOR HIGHER EDUCATION

Computer-based materials for the PET, Apple, and TRS-80 computers are available from CONDUIT, P.O. Box 388, Iowa City, Iowa 52244. Packages for higher education currently available include biology, chemistry, economics, education, geography, humanities, management science, mathematics, physics, political science, psychology, sociology, and statistics. Included in the CONDUIT package are a computer program written in BASIC or FORTRAN, a student guide, an instructor guide, notes explaining the installation of the materials on the computer, and the programs in a form that can be read by the user's particular computer.

PSI IN UNIVERSITY INSTRUCTION

Dr. Ron Sheese, Department of Psychology, York University, with support of the Educational Development Office has published a report entitled — **Personalized Methods of Instruction in University: Some Investigations and Comments** in which he discusses results of the use of PSI in terms of final exam performance, study behaviour, and student ratings and relates his findings with those of other researchers. Reprint requests should be directed to: Dr. Ron Sheese, Department of Psychology, York University, Downsview, Ontario M3J 1P3.

NEWS/NOTES

EDUCATING EDUCATORS

Humber College has announced a new certificate program for **Trainers and Educators.** The part-time program will appeal to anyone involved in the field of adult education or training. The first course under the leadership of **Dr. Marge Denis** will be offered this fall. For further information contact: Art Knowles, Continuing and Community Education 416-675-3111, ext. 411 or Dr. Ruth McLean, Professional Development, 416-675-3111, ext. 364.

EDUCATIONAL DEVELOPMENT AND WINDSOR

The **University of Windsor** has appointed **Dr. Lloyd Brown-John,** Department of Political Science, part-time coordinator of the **Teaching and Learning Program.** Dr. Brown-John has been associated with the program in the past and hopes to build on the work of his predecessors by continuing to support the activities of faculty at Windsor.

COMING EVENTS

SEPTEMBER

LIVING IN THE INFORMATION SOCIETY

23 September 1981 - 21 April 1982
Toronto

A series of workshops will be held at **Humber College of Applied Arts and Technology:**

23 September — "Living in the Information Society" — Keynote speaker is **Gordon Thompson,** Manager, Communications Studies, Bell Northern Research, Ottawa. Fee: $15.00 per session; $90.00 per package of seven.

21 October — "Language and Learning in the Information Society" — speaker is **David Godfrey,** Chairman of the Department of Creative Writing at the University of Victoria.

25 November — "Health Care and Medicine in the Information Society" — speaker is **Dominic Covvey,** Senior Research Fellow, Ontario Heart Foundation and Director of Cardiovascular Computing, Toronto General Hospital.

20 January 1982 — "Cultural Preparation for the Information Society" — speaker is **Richard Hill,** Chairman of the Photo/Electric Arts Department, Ontario College of Art, and director and founder of the Photo/Electric Arts Foundation.

17 February 1982 — "Art and Creativity in the Information Society" — speaker is **Sterling Beckwith,** Professor of Music and of Humanities, York University.

17 March 1982 — "Growing Up in the Information Society" — speaker is **Dennis Sullivan,** Director of Programming, Computer Software Dept., The Children's Television Workshop, New York.

21 April 1982 — "EVERYMAN in the Information Society" — speaker is **Harry Boyle,** former chairman of the Canadian Radio and Television Commission.

Contact: Humber College of Applied Arts & Technology, Registration Centre: Continuous Learning, 205 Humber College Blvd., Rexdale, Ontario M9W 5L7.

OCTOBER

ORGANIZATION DEVELOPMENT SKILLS

18-23 October 1981
Toronto

This is another workshop presented by University Associates of Canada, and is conducted as a simulated organization. Objectives are to practice skills in intervening in human systems; to explore OD themes used in various types of institutions; and to develop an awareness of issues related to members of pyramid-type organizations.

Fee: $720.00 (CAN.)

Contact: Registrar, University Associates of Canada, Inc., 4190 Fairview Street, Burlington, Ontario L7L 4Y8 (416-632-5832).

THE ROLE OF THE TUTOR IN SMALL GROUP LEARNING

19 October 1981
McMaster University, Hamilton

The goals of this workshop will be to: 1) gain an understanding of the rationale and use of small group learning and the role of the tutor as an educational facilitator; 2) provide monitored student group experience to enable participants to develop skills in facilitating learning, evaluation and group dynamics; and 3) develop skills in peer assessment.

Contact: Workshop Coordinator, Room 3H8j, McMaster University, Health Sciences Centre, 1200 Main St. West, Hamilton, Ontario L8N 3Z5. (416-525-9140, ext. 2112).

THE EVALUATION OF STUDENT PROGRESS IN A PROBLEM-BASED CURRICULUM

22 October 1981
McMaster University, Hamilton

This is one of a series of workshops in Health Sciences education and features such activities as: observation of students in action by participants followed by assessment of the students' performance; group discussions; and training in the use of several tools and methods.

Contact: Workshop Coordinator, Room 3H8j, McMaster University, Health Sciences Centre, 1200 Main Street West, Hamilton, Ontario L8N 3Z5 (416-525-9140, ext. 2112).

PROFESSIONAL AND ORGANIZATIONAL DEVELOPMENT (POD) ANNUAL CONFERENCE: LIVING AND LEARNING IN ACADEMIC CULTURES

22-24 October 1981
Westin Hotel, Cincinnati, Ohio

The program will be another lively experiment with a network conference — varied sessions, community-building activities and challenging ideas. There will be over two dozen sessions that will engage you in active learning, skill-building and investigation of new approaches to making our classes and institutions more effective and more humane.

Contact: Stephen Scholl, POD 1981, John F. Kennedy University, 12 Altarinda Road, Orinda, Cal. 94563.

MICROCOMPUTERS IN EDUCATION

22-24 October 1981
The Ontario Science Center, Toronto

Technical Education Research Centers, Inc., in cooperation with the Ontario Science Center offers a Hands-On Workshop Series. Some important topics are: "Overview of Educational Applications of Microcomputers"; "Evaluation of Educational Software"; "BASIC and Graphics I and II"; "Logo"; "Pascal"; "Microcomputers as Laboratory Instruments". One workshop: $135. (CAN); 2 Workshops: $255. and 3 Workshops: $365.00.

Contact: Ms. Joanne McCaw, The Ontario Science Center, 770 Don Mills Road, Don Mills, Ontario (416-429-4423).

A VISITORS' WORKSHOP: OVERVIEW OF MCMASTER APPROACH TO HEALTH SCIENCES EDUCATION

23 October 1981
McMaster University, Hamilton, Ontario

In conjunction with the Introductory Workshop, the Visitors' Workshop is designed to meet individual needs of visiting faculty educators by using the particular educational approaches in effect at McMaster. In addition to a general introduction to the McMaster approach, participants will be encouraged to explore individual interests through the selective use of resources.

Contact: Workshop Coordinator, Room 3H8j, McMaster University, Health Sciences Centre, 1200 Main Street West, Hamilton, Ontario (416-525-9140, ext. 2112).

ROLE PLAYING

23-25 October 1981
Toronto

A workshop presented by University Associates of Canada. Objectives will be to develop skills in creating and maximizing the usefulness of role plays in laboratory training designs, and to learn how to adapt and use role plays in a wide range of training situations, such as personal growth, leadership/management training, team building, and organization development.

Fee: $360.00 (CAN.)

Contact: Registrar, University Associates of Canada, Inc., 4190 Fairview Street, Burlington, Ontario L7L 4Y8 (416-632-5832).

DESIGN SKILLS: SMALL-GROUP TRAINING THEORY AND PRACTICE

25-30 October 1981
Toronto

A workshop presented by University Associates of Canada, participants will take part in various training designs employing a variety of experiential learning strategies; to gain competence in designing experience-based learning events; and to develop skills in facilitating small-group training sessions.

Fee: $720.00 (CAN.)

Contact: Registrar, University Associates of Canada Inc., 4190 Fairview Street, Burlington, Ontario L7L 4Y8 (416-632-5832).

CONSULTATION: DEFINITIONS AND SKILLS

26-27 October 1981
Holiday Inn, O'Hare, Schiller Park, Illinois

Increasingly, people in organizations are recognizing that internal and external consultants provide valuable help in long-range planning, improving the management of projects and conducting organization development activities. Based on a process consultation approach, this practical seminar focuses on: clarifying the consultant's role, how to conduct a "contracting" conference with a manager and the steps to follow in a consultation intervention. Instructors for this seminar will be Robert Chasnoff, Peter Muniz and Leon Butler.

Contact: LABS, 47 Unami Terrace, Westfirld, N.J. 07090 (201-233-4260).

EDUCATIONAL DEVELOPMENT WORKSHOPS

27 October to November 26 1981
University of Toronto

A series of workshops sponsored by the Office of Educational Development, University of Toronto:

27 October — "Techniques of Lecturing" — **Dr. Lee Davies,** Consultant, Office of Educational Development, University of Toronto.

5 November — "The Disabled Student in Higher Education" — Planning team: **Mrs. Eileen Barbeau, Professor Bill Vanderburg,** and **Dr. Lee Davies**

12 November — "Using Overhead Transparencies in Teaching & Research" — **Michael Edmunds,** Media Centre, University of Toronto, and **Dr. Lee Davies**

26 November — "Personalized Instruction in the Large Course" — Professor **Irv Tallan** and colleagues, Biology Department, University of Toronto.

Contact: The Office of Educational Development, University of Toronto (416-978-7009).

IMPACT: LEARNING AND TECHNOLOGY

28-30 October 1981
Park Plaza Hotel, Toronto

A conference sponsored jointly by the Ontario Association for Continuing Education and the Canadian Association for Adult Education, in co-operation with TVOntario. At this conference, perspectives will be developed on information technology through the eyes of policy planners, the elderly, educators, prisoners, the disabled, the disadvantaged, personnel in voluntary organizations, and the media.

Contact: Learning and Technology, 29 Prince Arthur Avenue, Toronto, Ontario M5R 1B2.

NOVEMBER

TWO WORKSHOPS FOR ADULT EDUCATORS

3-4 November & 24-25 November 1981
University of Guelph, Guelph

3-4 November — "Helping Adults Learn" — speaker will be **Professor Mark Waldron,** Director, University School of Part-Time Studies and Continuing Education, University of Guelph.

24-25 November — "Contemporary Communication Systems: Implications for Adult Continuing Education" — speaker is **Professor Ab Moore,** Director, Office for Educational Practice, University of Guelph.

Each day's sessions will consist of both seminars and workshops. Participants will have the opportunity to test and apply new teaching-learning techniques.

Fee: $235.00/each seminar/workshop, & includes tuition, materials and lunches.

Contact: Division of Continuing Education, University of Guelph, Guelph, Ontario N1G 2W1.

ANNUAL NATIONAL ASSEMBLY (CAEL)

16-18 November 1981
San Francisco

The theme of this conference will be "Quality and Autonomy", and is sponsored by the Council for the Advancement of Experiential Learning.

Contact: Ms. Diana Bamford-Rees, Council for the Advancement of Experiential Learning, Lakefront North, Ste. 300, Columbia, Md., U.S.A. 21044 (301-997-3535).

LAB MANUALS AND COURSE HANDOUTS

18 November 1981
University of Guelph, Guelph

Co-leaders will be: **Sue Corey,** Zoology Department, and **Don McIntosh** and **Ian Easterbrook** of the Office for Educational Practice. Do you wish to develop a lab manual or handouts for a course you are teaching, or to improve upon materials which already exist? Several people who have developed manuals for their courses will talk about their work, and the group will discuss criteria which can be useful in developing a manual or handouts, and in evaluating the results. Also to be discussed will be ways to fund the development of these materials.

Contact: Trev Dickinson, Co-ordinator, Instructional Development, Office for Educational Practice, Raithby House, University of Guelph. (519-824-4120, ext. 3106).

SIXTH NATIONAL ANNUAL CONFERENCE ON THE APPLICATION OF CURRICULUM RESEARCH

26-27 November 1981
University of Manitoba, Winnipeg

The conference's theme is the role of curriculum research. There will be a presentation of six selected Master's these or research papers which were submitted in response to an invitation from the Faculty of Education at the University of Manitoba. There will also be displays of curriculum materials being used in curriculum projects across Canada.

Contact: Winston E. Rampaul, University of Manitoba, Winnipeg, Manitoba R3T 2N2.

DECEMBER

SOCIETY FOR RESEARCH INTO HIGHER EDUCATION ANNUAL CONFERENCE

16-17 December 1981
Manchester Polytechnic, Manchester, U.K.

The theme for this SRHE conference is **Biases in Higher Education.** If higher education be regarded as a service to the community, what are the biases in that service which favour some people above others? What factors disadvantage, inhibit, exclude or discriminate against some sections of the population? Many of the questions raised by this theme are discussed under eight general topics: age, class, disability, geography, language, race, religion and sex.

Contact: Peter Jones, Staff Development Unit, Manchester Polytechnic, Bracken House, Charles Street, Manchester M1 7DF.

1982-83

MARCH

1982 AERA ANNUAL MEETING

19-23 March 1982
New York, N.Y.

APRIL

2ND INTERNATIONAL CONFERENCE ON PROFESSIONAL DEVELOPMENT OF ACADEMIC STAFF IN UNIVERSITIES

6-20 April 1982
Prince of Songkla University, Hatyai, Thailand

This conference will focus on two issues: 1) changes in the philosophy and practice of professional development which may have occurred at the institutional level since 1979; examination of what is done, why and how; and 2) the nature of efforts being made at the departmental level, to facilitate the professional development of academic staff; professional development as a component in the evolution of each discipline.

Contact: Dr. Alan G. Harding, University of Bradford, Bradford, West Yorkshire, E D7 1DP, England.

MAY

LEARNED SOCIETIES 1982

28 May - 12 June, 1982
University of Ottawa

Focal point of the meetings will be the celebration of the 100th anniversary of the Royal Society of Canada.

Contact: Dr. P. Babin, Conference Coordinator, University of Ottawa, Ottawa, Ontario

JUNE

12th WORLD CONFERENCE ON LEARNING AT A DISTANCE

9-15 June 1982
Vancouver, B.C.

The International Council for Correspondence Education has announced a call for ideas, themes, speakers and paper. If you have ideas for the program or wish your name on the conference mailing list . . .

Contact: Dr. J. Daniel, Program Chairman, Room 135, Admn. Bldg. Dean of Students Office, Loyola Campus, Concordia University, 1455 de Maisonneuve Blvd. West, Montreal, Quebec H3B 1M8.

SOCIETY FOR RESEARCH INTO HIGHER EDUCATION: PROFESSIONAL EDUCATION

December 1982
United Kingdom

Contact: David Billing, Council for National Academic Awards, 344-354 Gray's Inn Road, London, England WC1X 8BP.

1983 AERA ANNUAL MEETING

11-15 April 1983
Montreal, P.Q.

UNIVERSITY EDUCATION NEWS — a quarterly publication
ISSN: 0228 - 1872
Editor: Marion Wilburn
Subscription: Available free of charge to Ontario universities, otherwise $4.00 per annum
Contact: Office of Teaching and Learning
Council of Ontario Universities
130 St. George St., Suite 8039
Toronto, Ontario M5S 2T4
Tel. (416) 979-2165

COMPUTER CULTURE '81

November 16-22, 1981

Presented by the Photo/Electric Arts Foundation

at

The Ontario College of Art and other sites in Toronto

The 1981 Computer Culture Exposition is to be opened by Pierre Juneau, Deputy Minister of Communications, on Monday, November 16, and is to continue until the evening of Sunday, November 22. The general theme of the event is "Interface: Crossing Boundaries" and its presentation has been made possible by a Special Program of Cultural Initiatives grant approved by The Hon. Francis Fox, Minister of Communications.

OPEN CONFERENCE

An open conference featuring national and international speakers will be held in the auditorium of the Ontario College of Art during the evenings from Monday, November 16 to Friday, November 20, and during the daytime and evenings on Saturday and Sunday, November 21 and 22. The issues to be addressed are:
Mon. Nov. 16. Rethinking Culture and Technology
Tue. Nov. 17. Learning through Work, Play and Education
Wed. Nov. 18. Linking Creativity and Innovation
Thu. Nov. 19. Interfacing People, Industry and Government
Fri. Nov. 20. Rejuvenating Music, Art and Literature
Sat. Nov. 21. Living in a Microelectronic World
Sun. Nov. 22. Getting Value from Media

DISPLAYS AND DEMONSTRATIONS

Educational displays and demonstrations of a wide variety of computer related applications will be accommodated in the newly renovated atrium and adjoining space at the Ontario College of Art. Applications to be featured are:

- Advertising and Marketing
- Aiding the Disabled
- Buying and Banking
- Communications
- Computer Aided Design
- Computer Aided Manufacturing
- Education
- Entertainment and Recreation
- Health Care
- Managing and Accounting
- Printing and Typing
- Reference Information
- Security
- Translation

These displays and demonstrations are to be supplemented by an educational Book Stand.

SCHOOL TOUR PROGRAM

A program of school tours, oriented to careers and high technology, is to be conducted in the educational display area at the Ontario College of Art and in the auditorium of the Art Gallery of Ontario from Monday, November 16 to Friday, November 20 inclusive.

COMPUTER ANIMATION DAY

A day of computer animation will be featured in the auditorium of the Art Gallery of Ontario in the morning and afternoon of Saturday, November 21.

PHOTO/ELECTRIC ART EXHIBITION

An exhibition organized by Photo/Electric Arts students from The Ontario College of Art will be held in The Village by the Grange.

COMPUTER MUSIC SYMPOSIUM

A computer music symposium, including two concerts, will be held in The Music Gallery, beginning on Saturday evening, November 21 and ending on Sunday evening, November 22.

THE COMPUTER CULTURE ART SHOW '81

Ninety pieces of the world's best computer related art will be shown throughout Computer Culture '81 in The Flavio Belli Gallery and in Gallery 76 on McCaul Street.

MEDIA-WRAP-AROUND: A TRIBUTE TO MARSHALL McLUHAN

Media-wrap-around, created by U.S. artist Stan Vanderbeek as a tribute to Marshall McLuhan, will be activated in The Village by the Grange on Monday evening, November 16 and Saturday evening, November 21.

RELATED SEMINARS, COURSES AND CONFERENCES

Related short courses, seminars and conferences of special interest to various groups are to be held in The Ontario College of Art and The Village by the Grange during Computer Culture '81, beginning with "Computer Consciousness for Health Care Providers" and "Getting to Know Computers" on Saturday, November 14.

PERSONAL COMPUTING TRADE SHOW

A personal computing trade show will be held in The Village by the Grange from Friday, November 20 to Sunday, November 22.

TELEVISION COVERAGE AND DOCUMENTATION

A television studio is to be set up in The Village by the Grange for use by Rogers Cable. Plans are underway for the production of related TV programs drawing on material from Computer Culture '81. The Open Conference is to be documented by a broadcast quality sound recording which is to be used to provide material for the publication of an anthology.

CANADIAN COMPUTER SHOW AND CONFERENCE

The Canadian Computer Show and Conference opens on the same day as Computer Culture '81. This event, sponsored by the Canadian Information Processing Society, is to be held at the International Centre near Malton airport from Monday, November 16 to Thursday, November 19. It includes a conference and North America's second largest trade show, both of which are open daily. The Canadian Computer Show and Conference complements and is complemented by Computer Culture '81.

FOR FURTHER INFORMATION WRITE TO:
Computer Culture '81
Box 7109, Postal Station A,
TORONTO, Ontario
Canada. M5W 1X8

tel: (416) 367-0580